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of Transportation
**Federal Aviation
Administration**

Airman's Information Manual

Official Guide to Basic Flight Information and ATC Procedures

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AIRMAN'S INFORMATION MANUAL (AIM)

BASIC FLIGHT INFORMATION AND ATC PROCEDURES

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The following is, in essence, the statement issued by the FAA Administrator and published in the December 10, 1964, issue of the Federal Register, concerning the FAA policy as pertaining to the type of information that will be published as NOTAMs and in the Airman's Information Manual.

It is a pilot's inherent responsibility that he be alert at all times for and in anticipation of all circumstances, situations and conditions which affect the safe operation of his aircraft. For example, a pilot should expect to find air traffic at any time or place. At or near both civil and military airports and in the vicinity of known training areas, a pilot should expect concentrated air traffic although he should realize concentrations of air traffic are not limited to these places.

It is the general practice of the agency to advertise by NOTAM or other flight information publications such information it may deem appropriate; information which the agency may from time to time make available to pilots is solely for the purpose of assisting them in executing their regulatory responsibilities. Such information serves the aviation community as a whole and not pilots individually.

The fact that the agency under one particular situation or another may or may not furnish information does not serve as a precedent of the agency's responsibility to the aviation community; neither does it give assurance that other information of the same or similar nature will be advertised nor does it guarantee that any and all information known to the agency will be advertised.

Consistent with the foregoing, it shall be the policy of the Federal Aviation Administration to furnish information only when, in the opinion of the agency, a unique situation should be advertised and not to furnish routine information such as concentrations of air traffic, either civil or military. The Airman's Information Manual will not contain informative items concerning everyday circumstances that pilots should, either by good practice or regulation, expect to encounter or avoid.

AIRMAN'S INFORMATION MANUAL (AIM)

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AIRMAN'S INFORMATION MANUAL (AIM)

FOREWORD

This manual is designed to provide airmen with basic flight information and ATC procedures for use in the National Airspace System (NAS) of the United States. The information contained parallels the U.S. Aeronautical Information Publication (AIP) distributed internationally.

This manual contains the fundamentals required in order to fly in the U.S. NAS. It also contains items of interest to pilots concerning health and medical facts, factors affecting flight safety, a pilot/controller glossary of terms used in the Air Traffic Control System, and information on safety, accident and hazard reporting.

This manual is complemented by other operational publications which are available upon separate subscription. These publications are:

Notices to Airmen (Class-II)— A publication containing current Notices to Airmen (NOTAMs) which are considered essential to the safety of flight as well as supplemental data affecting the other operational publications listed here. It also includes current FDC NOTAMs, which are regulatory in nature, issued to establish restrictions to flight or amend charts or published Instrument Approach Procedures. This publication is issued every 14 days and is available through subcription from the Superintendent of Documents.

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NOTE— The above information relating to FARs and ACs is extracted from AC 00-2, *Advisory Circulars and Status of Federal Regulations*. Many of the FARs and ACs listed in AC 00-2 are cross-referenced in the AIM. These regulatory and nonregulatory references cover a wide range of subjects and are a source of detailed information of value to airmen. AC 00-2 is issued every four months and can be obtained free-of-charge from:

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EXPLANATION OF MAJOR CHANGES

Para 41. d VISUAL APPROACH SLOPE INDICATOR (VASI)— Paragraph revised for clarity.

Para 42. b NOTE. OTHER VISUAL APPROACH SLOPE SYSTEMS— Paragraph revised for clarity.

Para 48. b NOTE. AIRPORT (ROTATING) BEACONS— Paragraph revised for clarity.

Para 101. b AIRPORT RADAR SERVICE AREA (ARSA) OPERATION— Paragraph revised to change Safety Advisory to' Safety Alert.

Para 153. b RECORDING AND MONITORING— A subparagraph was added to clarify the recording of public access telephones.

Para 161. b EXAMPLE. AUTOMATIC TERMINAL INFORMATION SERVICE (ATIS)— Paragraph revised because of change from Greenwich Mean Time (GMT) to Coordinated Universal Time (UTC).

Para 161. d AUTOMATIC TERMINAL INFORMATION SERVICE (ATIS)— Paragraph revised for clarity.

Para 162. c (1) (e) EXAMPLES. RADAR TRAFFIC INFORMATION SERVICE— This change deletes the requirement to state "UNVERIFIED" when issuing traffic advisories of unverified MODE C readouts.

Para 163. SAFETY ALERT— Paragraph retitled and revised to establish emphasis and improve clarity of this procedure.

Para 204. a TIME— Paragraph revised because of change from Greenwich Mean Time (GMT) to Coordinated Universal Time (UTC).

Para 264. c NOTE. SPECIAL [illegible] CLEARANCES— Note was added to [illegible] pilot responsibility.

Para 305. b GENERAL INSTRUCTIONS FOR THE FAA FLIGHT PLAN FORM— Paragraph revised because of change from Greenwich Mean Time (GMT) to Coordinated Universal Time (UTC).

Para 362. APPROACH CONTROL— Paragraph revised to include Microwave Landing System (MLS).

Para 374. RADAR MONITORING OF INSTRUMENT APPROACHES— Paragraph revised to include Microwave Landing System (MLS).

Para 375. SIMULTANEOUS ILS/MLS APPROACHES— Paragraph retitled and revised to include Microwave Landing System (MLS).

Para376. PARALLEL ILS/MLS APPROACHES— Paragraph retitled and revised to include Microwave Landing System (MLS).

Para .381. a WEATHER MINIMUMS— This paragraph has been amended to delete the reference to Advisory Circular 90-1, which has been cancelled.

Para 386. LANDING PRIORITY— Paragraph revised to include Microwave Landing System (MLS).

Para 400. c GENERAL— Paragraph revised to change Safety Advisory to Safety Alert.

Para 403. a (2) (f) INSTRUMENT APPROACH— Paragraph revised to highlight restrictive notations on IAPs.

Para 406. SAFETY ALERT— Paragraph retitled and revised to establish emphasis and improve clarity of this procedure.

Para 407. b (2) SEE AND AVOID— Paragraph revised to change Safety Advisory to Safety Alert.

Para 460. c d DISTRESS AND URGENCY COMMUNICATIONS— The term PAN has been changed to PAN-PAN; its definition is unchanged.

Para 461. a (3) (a) OBTAINING EMERGENCY ASSISTANCE— The term PAN has been changed to PAN-PAN; its definition is unchanged.

Para 464. EXAMPLES. FUEL DUMPING— Changes the phraseology to reduce transmission time.

Para 508. a (4) EXAMPLE. IN-FLIGHT WEATHER BROADCASTS— Paragraph revised because of change from Greenwich Mean Time (GMT) to Coordinated Universal Time (UTC).

Para 520. e PILOT WEATHER REPORTS (PIREP)— Paragraph revised because of change from Greenwich Mean Time (GMT) to Coordinated Universal Time (UTC).

Para 521. b (4) EXAMPLE. PIREPS RELATING TO AIRFRAME ICING— Paragraph revised because of change from Greenwich Mean Time (GMT) to Coordinated Universal Time (UTC).

Para 522. a (2) PIREPS RELATING TO TURBULENCE— Paragraph revised because of change from Greenwich Mean Time (GMT) to Coordinated Universal Time (UTC).

Para 528. AUTOB DECODING KEY— Table revised because of change from Greenwich Mean Time (GMT) to Coordinated Universal Time (UTC).

Para 540. d GENERAL— This subparagraph has been deleted; it is no longer appropriate.

Para 582. c (1) NEAR MIDAIR COLLISION REPORTING— Paragraph revised because of change from Greenwich Mean Time (GMT) to Coordinated Universal Time (UTC), and to clarify NMAC procedures.

Para 625. AUXILIARY CHARTS— Chart information updated.

EXTERNAL REFERENCES

All reference to Advisory Circulars and other FAA publications in the Airman's Information Manual include the FAA Advisory Circular or Manual identification numbers (when available); however, due to varied publication dates, the basic publication letter is not included (Example: The Controller's Handbook 7110.65D is referenced as 7110.65.) To insure that you are consulting the latest information when referencing one of these other documents, use the FAA Advisory Circular AC: 00-2XX, Advisory Circular Checklist (and Status of Other FAA Publications).

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Chapter 1. NAVIGATION AIDS

Section 1. AIR NAVIGATION RADIO AIDS

1. GENERAL

Various types of air navigation aids are in use today, each serving a special purpose in our system of air navigation. These aids have varied owners and operators namely: the Federal Aviation Administration (FAA), the military services, private organizations, individual states and foreign governments. The FAA has the statutory authority to establish, operate, maintain air navigation facilities and to prescribe standards for the operation of any of these aids which are used by both civil and military aircraft for instrument flight in federally controlled airspace. These aids are tabulated in the Airport/Facility Directory.

NOTE- Multiple navigation aids are often used in instrument flight procedures. Proper selection, tuning, and identification is essential for safe instrument flight. For example, when using DME during instrument approach procedures, the DME source may or may not be collocated with the facility providing course guidance.

2. NONDIRECTIONAL RADIO BEACON (NDB)

a. A low or medium frequency radio beacon transmits nondirectional signals whereby the pilot of an aircraft properly equipped can determine his bearing and "home" on the station. These facilities normally operate in the frequency band of 190 to 535 kHz and transmit a continuous carrier with either 400 Hz or 1020 Hz modulation keyed to provide identification except during voice transmission.

b. When a radio beacon is used in conjunction with the Instrument Landing System markers, it is called a Compass Locator.

c. All radio beacons except the compass locators transmit a continuous three-letter identification in code except during voice transmissions. Compass locators transmit a continuous two-letter identification in code. The first and second letters of the three-letter location identifiers are assigned to the front course outer marker compass locator (LOM), and the second and third letters are assigned to the front course middle marker compass locator (LMM).

EXAMPLE:

ATLANTA, ATL, LOM-AT, LMM-TL.

d. Voice transmissions are made on radio beacons unless the letter "W" (without voice) is included in the class designator (HW).

e. Radio beacons are subject to disturbances that may result in erroneous bearing information. Such disturbances result from intermittent/unpredictable signal propagation due to such factors as lightning, precipitation static, etc. At night radio beacons are vulnerable to interference from distant stations. Nearly all disturbances which affect the ADF bearing also affect the facility's identification: noisy identification usually occurs when the ADF needle is erratic; voice, music, or erroneous identification will usually be heard when a steady false bearing is being displayed. Since ADF receivers do not have a "FLAG" to warn the pilot when erroneous bearing information is being displayed, the pilot should continuously monitor the NDB's identification.

3. VHF OMNI-DIRECTIONAL RANGE (VOR)

a. VORs operate within the 108.0 to 117.95 MHz frequency band and have a power output necessary to provide coverage within their assigned operational service volume. The equipment is VHF, thus, it is subject to line-of-sight restriction, and its range varies proportionally to the altitude of the receiving equipment. The normal service ranges for the various classes of VORs are given in PARA. 10.c.

b. Most VORs are equipped for voice transmission on the VOR frequency. VORs without voice capability are indicated by the letter "W" (without voice) included in the class designator (VORW).

c. The effectiveness of the VOR depends upon proper use and adjustment of both ground and airborne equipment.

(1) Accuracy: The accuracy of course alignment of the VOR is excellent, being generally plus or minus 1 degree.

(2) Roughness: On some VORs, minor course roughness may be observed, evidenced by course needle or brief flag alarm activity (some receivers are more subject to these irregularities than others). At a few stations, usually in mountainous terrain, the pilot may occasionally observe a brief course needle oscillation, similar to the indication of "approaching station." Pilots flying over unfamiliar routes are cautioned to be on the alert for these vagaries, and in particular, to use the "to/from" indicator to determine positive station passage.

(a) Certain propeller RPM settings can cause the VOR Course Deviation Indicator to fluctuate as much as plus or minus six degrees. Slight changes to the RPM setting will normally smooth out this roughness. Helicopter rotor speeds may also cause VOR course disturbances. Pilots are urged to check for this propeller modulation phenomenon prior to reporting a VOR station or aircraft equipment for unsatisfactory operation.

d. The only positive method of identifying a VOR is by its Morse Code identification or by the recorded automatic voice identification which is always indicated by use of the word "VOR" following the range's name. Reliance on determining the identification of an omnirange should never be placed on listening to voice transmissions by the Flight Service Station (FSS) (or approach control facility) involved. Many FSSs remotely operate several omniranges with different names. In some cases, none of the VORs have the name of the "parent" FSS.

NOTE- During periods of maintenance, the facility may radiate a T-E-S-T code (— ● ●●● —) or the code may be removed.

e. Voice identification has been added to numerous VHF omniranges. The transmission consists of a voice announcement, "AIRVILLE VOR" alternating with the usual Morse Code identification.

4. VOR RECEIVER CHECK

a. Periodic VOR receiver calibration is most important. If a receiver's Automatic Gain Control or modulation circuit deteriorates, it is possible for it to display acceptable accuracy and sensitivity close into the VOR or VOT and display out-of-tolerance readings when located at greater distances where weaker signal areas exist. The likelihood of this deterioration varies between receivers, and is generally considered a function of time. The best assurance of having an accurate receiver is periodic calibration. Yearly intervals are recommended at which time an authorized repair facility should recalibrate the receiver to the manufacturer's specifications.

b. Federal Aviation Regulations (FAR 91.25) provides for certain VOR equipment accuracy checks prior to flight under instrument flight rules. To comply with this requirement and to ensure satisfactory operation of the airborne system, the FAA has provided pilots with the following means of checking VOR receiver accuracy:

(1) FAA VOR test facility (VOT) or a radiated test signal from an appropriately rated radio repair station.

(2) Certified airborne check points.

(3) Certified check points on the airport surface.

c. The FAA VOR test facility (VOT) transmits a test signal for VOR receivers which provides users of VOR a convenient and accurate means to determine the operational status of their receivers. The VOT is designed to provide a means of checking the accuracy of a VOR receiver while on the ground where a VOT is located. The airborne use of VOT is permitted; however, its use is strictly limited to those areas/altitudes specifically authorized in the Airport/Facility Directory or appropriate supplement. To utilize the VOT service, tune in the advertised VOT frequency on your VOR receiver. With the Course Deviation Indicator (CDI) centered, the omni-bearing selector should read 0 degrees with the to/from indication showing "from" or the omni-bearing selector should read 180 degrees with the to/from indication showing "to". Should the VOR receiver operate an RMI (Radio Magnetic Indicator), it will indicate 180 degrees on any OBS setting when using the VOT. Two means of identification are used with the VOR radiated test signal. In some cases a continuous series of dots is used while in others a continuous 1020 Hz tone will identify the test signal. Information concerning an individual test signal can be obtained from the local FSS.

d. A radiated VOR test signal from an appropriately rated radio repair station serves the same purpose as an FAA VOR signal and the check is made in much the same manner with the following differences:

(1) The frequency normally approved by the FCC is 108.0 MHz.

(2) The repair stations are not permitted to radiate the VOR test signal continuously; consequently, the owner or operator must make arrangements with the repair station to have the test signal transmitted. This service is not provided by all radio repair stations, the aircraft owner or operator must determine which repair station in his local area does provide this service. A representative of the repair station must make an entry into the aircraft logbook or other permanent record certifying to the radial accuracy which was transmitted and the date of transmission. The owner or operator or representative of the repair station may accomplish the necessary checks in the aircraft and make a logbook entry stating the results of such checks. It will be necessary to verify with the appropriate repair station the test radial being transmitted and whether you should get a "to" or "from" indication.

e. Airborne and ground check points consist of certified radials that should be received at specific points on the airport surface, or over specific landmarks while airborne in the immediate vicinity of the airport.

(1) Should an error in excess of plus or minus 4 degrees be indicated through use of a ground check, or plus or minus 6 degrees using the airborne check, IFR flight shall not be attempted without first correcting the source of the error.

CAUTION: No correction other than the correction card figures supplied by the manufacturer should be applied in making these VOR receiver checks.

(2) Locations of airborne check points, ground check points and VOTs are published in the Airport/Facility Directory.

(3) If dual system VOR (units independent of each other except for the antenna) is installed in the aircraft, the person checking the equipment may check one system against the other. He shall turn both systems to the same VOR ground facility and note the indicated bearing to that station. The maximum permissible variations between the two indicated bearings is 4 degrees.

5. TACTICAL AIR NAVIGATION (TACAN)

a. For reasons peculiar to military or naval operations (unusual siting conditions, the pitching and rolling of a naval vessel, etc.) the civil VOR/DME system of air navigation was considered unsuitable for military or naval use. A new navigational system, TACAN, was therefore developed by the military and naval forces to more readily lend itself to military and naval requirements. As a result, the FAA has been in the process of integrating TACAN facilities with the civil VOR/DME program. Although the theoretical, or technical principles of operation of TACAN equipment are quite different from those of VOR/DME facilities, the end result, as far as the navigating pilot is concerned, is the same. These integrated facilities are called VORTAC's.

b. TACAN ground equipment consists of either a fixed or mobile transmitting unit. The airborne unit in conjunction with the ground unit reduces the transmitted signal to a visual presentation of both azimuth and distance information. TACAN is a pulse system and operates in the UHF band of frequencies. Its use requires TACAN airborne equipment and does not operate through conventional VOR equipment.

6. VHF OMNI-DIRECTIONAL RANGE/TACTICAL AIR NAVIGATION (VORTAC)

a. A VORTAC is a facility consisting of two components, VOR and TACAN, which provides three individual services: VOR azimuth, TACAN azimuth and TACAN distance (DME) at one site. Although consisting of more than one component, incorporating more than one operating frequency, and using more than one antenna system, a VORTAC is considered to be a unified navigational aid. Both components of a VORTAC are envisioned as operating simultaneously and providing the three services at all times.

b. Transmitted signals of VOR and TACAN are each identified by three-letter code transmission and are interlocked so that pilots using VOR azimuth with TACAN distance can be assured that both signals being received are definitely from the same ground station. The frequency channels of the VOR and the TACAN at each VORTAC facility are "paired" in accordance with a national plan to simplify airborne operation.

7. DISTANCE MEASURING EQUIPMENT (DME)

a. In the operation of DME, paired pulses at a specific spacing are sent out from the aircraft (this is the interrogation) and are received at the ground station. The ground station (transponder) then transmits paired pulses back to the aircraft at the same pulse spacing but on a different frequency. The time required for the round trip of this signal exchange is measured in the airborne DME unit and is translated into distance (Nautical Miles) from the aircraft to the ground station.

b. Operating on the line-of-sight principle, DME furnishes distance information with a very high degree of accuracy. Reliable signals may be received at distances up to 199 NM at line-of-sight altitude with an accuracy of better than 1/2 mile or 3 percent of the distance, whichever is greater. Distance information received from DME equipment is SLANT RANGE distance and not actual horizontal distance.

c. DME operated on frequencies in the UHF spectrum between 962 MHz and 1213 MHz. Aircraft equipped with TACAN equipment will receive distance information from a VORTAC automatically, while aircraft equipped with VOR must have a separate DME airborne unit.

d. VOR/DME, VORTAC, ILS/DME, and LOC/DME navigation facilities established by the FAA provide course and distance information from collocated components under a frequency pairing plan. Aircraft receiving equipment which provides for automatic DME selection assures reception of azimuth and distance information from a common source whenever designated VOR/DME, VORTAC, ILS/DME, and LOC/DME are selected.

e. Due to the limited number of available frequencies, assignment of paired frequencies has been required for certain military noncollocated VOR and TACAN facilities which serve the same area but which may be separated by distances up to a few miles. The military is presently undergoing a program to collocate VOR and TACAN facilities or to assign nonpaired frequencies to those that cannot be collocated.

f. VOR/DME, VORTAC, ILS/DME, and LOC/DME facilities are identified by synchronized identifications which are transmitted on a time share basis. The VOR or localizer portion of the facility is identified by a coded tone modulated at 1020 Hz or a combination of code and voice. The TACAN or DME is identified by a coded tone modulated at 1350 Hz. The DME or TACAN coded identification is transmitted one time for each three or four times that the VOR or localizer coded identification is transmitted. When either the VOR or the DME is inoperative, it is important to recognize which identifier is retained for the operative facility. A single coded identification with a repetition interval of approximately 30 seconds indicates that the DME is operative.

g. Aircraft receiving equipment which provides for automatic DME selection assures reception of azimuth and distance information from a common source whenever designated VOR/DME, VORTAC and ILS/DME navigation facilities are selected. Pilots are cautioned to disregard any distance displays from automatically selected DME equipment whenever VOR or ILS facilities, which do not have the DME feature installed, are being used for position determination.

8—9. RESERVED

10. NAVAID SERVICE VOLUMES

a. Most air navigation radio aids which provide positive course guidance have a designated standard service volume (SSV). The SSV defines the reception limits of unrestricted NAVAIDS which are usable for random/unpublished route navigation.

b. A NAVAID will be classified as restricted if it does not conform to flight inspection signal strength and course quality standards throughout the published SSV, except that the NAVAID should not be considered usable at altitudes below that which could be flown while operating under random route IFR conditions; even though these altitudes may lie within the designated SSV. Service volume restrictions are first published in the Notices to Airman (NOTAM) and then with the alphabetical listing of the NAVAID's in the Airport/Facility Directory.

NOTE- Refer to FAR 91.119 for *Minimum Altitudes for IFR Operations.*

c. Standard Service Volume limitations do not apply to published IFR routes or procedures.

d. VOR/DME/TACAN STANDARD SERVICE VOLUMES (SSV)

SSV CLASS DESIGNATOR	ALTITUDE AND RANGE BOUNDARIES
T (Terminal)	From 1000 feet above ground level (AGL) up to and including 12,000 feet AGL at radial distances out to 25 See Figures 10-3 and 10-4.
L (Low Altitude)	From 1000 feet AGL up to and including 18,000 feet AGL at radial distances out to 40 NM. See Figures and 10-5.
H (High Altitude)	From 1000 feet AGL up to and including 14,500 feet AGL at radial distances out to 40 NM. From 14,500 AGL up to and including 60,000 feet at radial distances out to 100 NM. From 18,000 feet AGL up to including 45,000 feet AGL at radial distances out to 130 NM. See Figures 10-1 and 10-5.

FIGURE 10-1. STANDARD HIGH ALTITUDE SERVICE VOLUME

(refer to FIGURE 5 for altitudes below 1000 feet)

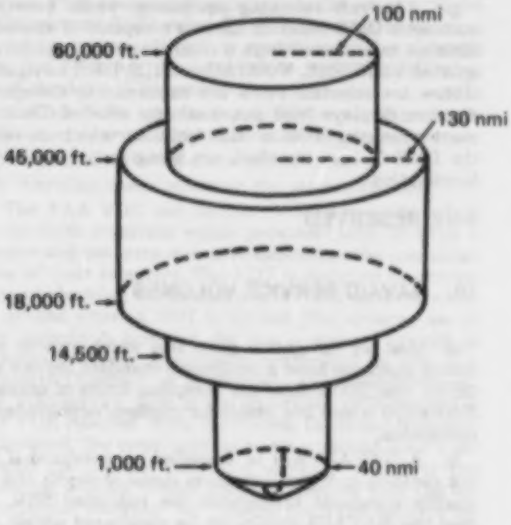
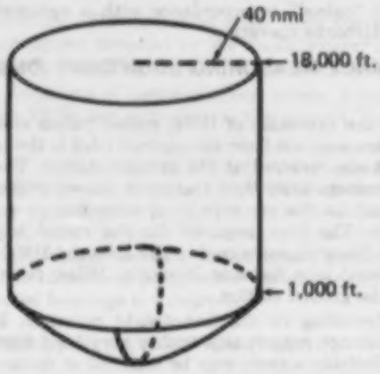


FIGURE 10-2. STANDARD LOW ALTITUDE SERVICE VOLUME

(refer to FIGURE 5 for altitudes below 1000 feet)



NOTE: All elevations shown are with respect to the station's site elevation (AGL). Coverage is not available in a cone of airspace directly above the facility.

FIGURE 10-3. STANDARD TERMINAL SERVICE VOLUME

(refer to FIGURE 4 for altitudes below 1000 feet)

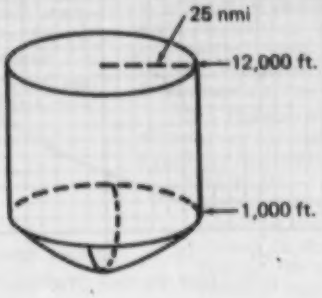


FIGURE 10-4. DEFINITION OF THE LOWER EDGE OF THE STANDARD T (TERMINAL) SERVICE VOLUME

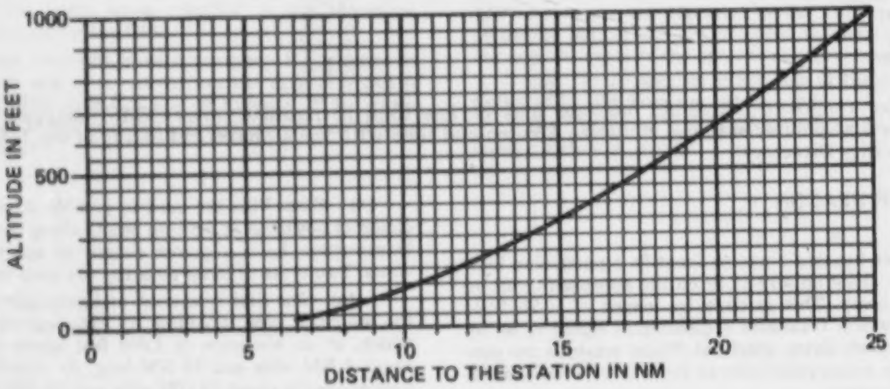
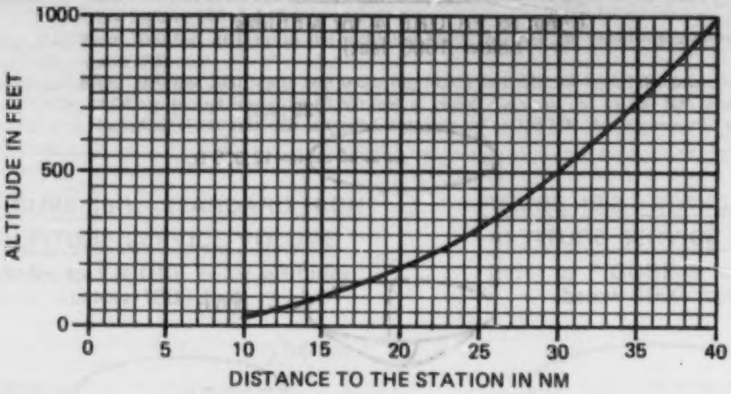


FIGURE 10-5. DEFINITION OF THE LOWER EDGE OF THE STANDARD H (HIGH) AND L (LOW) SERVICE VOLUMES



These standard service volumes (SSVs) are graphically shown in Figures 10-1 through 10-5. The SSV of a station is indicated by using the class designator as a prefix to the station type designation.

EXAMPLE:

TVOR, LDME, and HVORTAC.

Within 25 NM, the bottom of the T service volume is defined by the curve in Figure 10-4. Within 40 NM, the bottoms of the L and H service volumes are defined by the curve in Figure 10-5.

e. NONDIRECTIONAL RADIO BEACON (NDB)

NDBs are classified according to their intended use. The ranges of NDB service volumes are shown below. The distances (radius) are the same at all altitudes.

CLASS	DISTANCE (RADIUS)
Compass Locator	15 NM
MH	25 NM
H	50 NM*
HH	75 NM

* Service ranges of individual facilities may be less than 50 nautical miles (NM). Restrictions to service volumes are first published in the Notice to Airmen and then with the alphabetical listing of the NAVAID in the Airport/Facility Directory.

11. MARKER BEACON

a. Marker beacons serve to identify a particular location in space along an airway or on the approach to an instrument runway. This is done by means of a 75 MHz transmitter which transmits a directional signal to be received by aircraft flying overhead. These markers are generally used in conjunction with en route NAVAIDs and ILS as point designators.

b. There are three classes of en route marker beacons: Fan Marker (FM), Low Powered Fan Markers (LFM) and Z Markers. They transmit the letter "R" (dot dash dot) identification, or (if additional markers are in the same area) the letter "K," "P," "X," or "Z."

(1) Class FMs are used to provide a positive identification of positions at definite points along the airways. The transmitters have a power output of approximately 100 watts. Two types of antenna array are used with class FMs.

(a) The first type used, and generally referred to as the standard type, produces an elliptical shaped pattern, which, at an elevation of 1,000 feet above the station, is about 4 NM wide and 12 NM long. At 10,000 feet the pattern widens to about 12 NM wide and 35 NM long.

(b) The second array produces a dumbbell or bone-shaped pattern, which, at the "handle", is about three miles wide at 1,000 feet. The boneshaped marker is preferred at approach control locations where "timed" approaches are used.

(2) The class LFM or low powered FMs have a rated power output of 5 watts. The antenna array produces a circular pattern which appears elongated at right angles to the airway due to the directional characteristics of the aircraft receiving antenna.

(3) The Station Location, or Z-Marker, was developed to meet the need for a positive position indicator for aircraft operating under instrument flight conditions to show the pilot when he was passing directly over a low frequency navigational aid. The marker consists of a 5 watt transmitter and a directional antenna array which is located on the range plot between the towers or the loop antennas.

NOTE— Information concerning marker beacons which are used in conjunction with ILS systems is included in PARA. 12 - INSTRUMENT LANDING SYSTEMS (ILS).

12. INSTRUMENT LANDING SYSTEM (ILS)

a. GENERAL

(1) The ILS is designed to provide an approach path for exact alignment and descent of an aircraft on final approach to a runway.

(2) The ground equipment consists of two highly directional transmitting systems and, along the approach, three (or fewer) marker beacons. The directional transmitters are known as the localizer and glide slope transmitters.

(3) The system may be divided functionally into three parts:

(a) **Guidance information —** localizer, glide slope

(b) **Range information —** marker beacon, DME

(c) **Visual information —** approach lights, touchdown and centerline lights, runway lights

(4) Compass locators located at the Outer Marker (OM) or Middle Marker (MM) may be substituted for marker beacons. DME, when specified in the procedure, may be substituted for the OM.

(5) Some locations have a complete ILS system installed on each end of a runway; on the approach end of Runway 4 and the approach end of Runway 22 for example. When such is the case, the ILS systems are not in service simultaneously.

b. LOCALIZER

(1) The localizer transmitter, operating on one of the 40 ILS channels within the frequency range of 108.10 MHz to 111.95 MHz, emits signals which provide the pilot with course guidance to the runway centerline.

(2) The approach course of the localizer, which is used with other functional parts, e.g., glide slope, marker beacons, etc., is called the front course. The localizer signal emitted from the transmitter at the far end of the runway is adjusted, if possible, so that the distance between a full scale *fly-left* to a full scale *fly-right* indication (±150 microamperes) would equate to a linear width of approximately 700 feet at the runway threshold to provide a uniform sensitivity/response rate.

(3) The course line along the extended centerline of a runway, in the opposite direction to the front course is called the back course.

> *CAUTION:* — unless the aircraft's ILS equipment includes reverse sensing capability, when flying inbound on the back course it is necessary to steer the aircraft in the direction opposite of the needle deflection on the airborne instrument when making corrections from off-course to on-course. This "flying away from the needle" is also required when flying outbound on the front course of the localizer. DO NOT UTILIZE BACK COURSE SIGNALS for approach unless a BACK COURSE APPROACH PROCEDURE has been published for the particular runway and is authorized by ATC.

(4) Identification is in International Morse Code and consists of a three-letter identifier preceded by the letter I (..) transmitted on the localizer frequency.

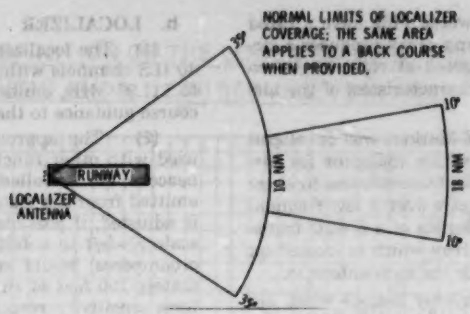
EXAMPLE:

I-DIA

(5) The localizer provides course guidance throughout the descent path to the runway threshold from a distance of 18 NM from the antenna between an altitude of 1,000 feet above the highest terrain along the course line and 4,500 feet above the elevation of the antenna site. Proper off-course indications are provided throughout the following angular areas of the operational service volume:

(a) To 10 degrees either side of the course along a radius of 18 NM from the antenna, and

(b) From 10 to 35 degrees either side of the course along a radius of 10 NM.



NORMAL LIMITS OF LOCALIZER COVERAGE; THE SAME AREA APPLIES TO A BACK COURSE WHEN PROVIDED.

(6) Proper off-course indications are generally not provided between 35 to 90 degrees either side of the localizer course. Therefore, instrument indications of possible courses in the area from 35 to 90 degrees off-course should be disregarded. All unrestricted localizer facilities provide reliable course guidance information within the areas described above.

c. LOCALIZER—TYPE DIRECTIONAL AID

(1) The Localizer-type Directional Aid (LDA) is of comparable utility and accuracy to a localizer but is not part of a complete ILS. The LDA course usually provides a more precise approach course than the similar Simplified Directional Facility (SDF) installation, which may have a course width of 6 or 12 degrees. The LDA is not aligned with the runway. Straight-in minima may be published where alignment does not exceed 30 degrees between the course and runway. Circling minima only are published where this alignment exceeds 30 degrees.

d. GLIDE SLOPE

(1) The UHF glide slope transmitter, operating on one of the 40 ILS channels within the frequency range 329.15 MHz, to 335.00 MHz radiates its signals in the direction of the localizer front course.

> *CAUTION:* Spurious glide slope signals may exist in the area of the localizer back course approach which can cause the glide slope flag alarm to disappear and present unreliable glide slope information. Disregard all glide slope signal indications when making a localizer back course approach unless a glide slope is specified on the approach and landing chart.

(2) The glide slope transmitter is located between 750 feet and 1,250 feet from the approach end of the runway (down the runway) and offset 250 to 650 feet from the runway centerline. It transmits a glide path beam 1.4 degrees wide.

NOTE— The term "glide path" means that portion of the glide slope that intersects the localizer.

(3) The glide path projection angle is normally adjusted to 3 degrees above horizontal so that it intersects the MM at about 200 feet and the OM at about 1,400 feet above the runway elevation. The glide slope is normally usable to the distance of 10 NM. However, at some locations, the glide slope has been certified for an extended service volume which exceeds 10 NM.

(4) In addition to the desired glide path, false course and reversal in sensing will occur at vertical angles considerably greater than the usable path. The proper use of the glide slope requires that the pilot maintain alertness as the glide path interception is approached and interpret correctly the "fly-up" and "fly-down" instrument indications to avoid the possibility of attempting to follow one of the higher angle courses. Provided that procedures are correctly followed and pilots are properly indoctrinated in glide path instrumentation, these high angle courses should cause no difficulty in the glide path navigation.

(5) Every effort should be made to remain on the indicated glide path (reference: FAR 91.87(d)(2)). Extreme caution should be exercised to avoid deviations below the glide path so that the predetermined obstacle/terrain clearance provided by an ILS IAP is maintained.

(6) A glide path facility provides a glidepath suitable for navigation down to the lowest authorized decision height (DH) specified in the approved ILS approach procedure. The glidepath may not be suitable for navigation below the lowest authorized DH and any reference to glidepath indications below that height must be supplemented by visual reference to the runway environment. Glide slopes which support low visibility operations with no published DH are usable to runway threshold.

(7) The published glide slope threshold crossing height (TCH) *DOES NOT* represent the height of the actual glide slope on course indication above the runway threshold. It is a theoretical height which represents a projection of the average or mean glidepath between four miles and the middle marker. For practical application, it is a reference used for planning purposes which represents the height above the runway threshold that an aircraft's glide slope antenna should be, if that aircraft remains on a trajectory formed by the four-mile-to-middle marker glidepath segment.

(8) Pilots must be aware of the vertical height between the aircraft's glide slope antenna and the main gear in the landing configuration and, at the DH, plan to adjust the descent angle accordingly if the published TCH indicates that the wheel crossing height over the runway threshold may not be satisfactory. Tests have indicated a comfortable wheel crossing height to be approximately 20 to 30 feet, depending on the type of aircraft.

e. DISTANCE MEASURING EQUIPMENT (DME)

(1) When installed with the ILS and specified in the approach procedure, DME may be used:

(a) In lieu of the OM.

(b) As a back course (BC) final approach fix (FAF).

(c) To establish other fixes on the localizer course.

(2) In some cases, DME from a separate facility may be used within Terminal Instrument Procedures (TERPS) limitations:

(a) To provide ARC initial approach segments.

(b) As a FAF for BC approaches.

(c) As a substitute for the OM.

f. MARKER BEACON

(1) ILS marker beacons have a rated power output of 3 watts or less and an antenna array designed to produce a elliptical pattern with dimensions, at 1,000 feet above the antenna, of approximately 2,400 feet in width and 4,200 feet in length. Airborne marker beacon receivers with a selective sensitivity feature should always be operated in the "low" sensitivity position for proper reception of ILS marker beacons.

(2) Ordinarily, there are two marker beacons associated with an ILS, the OM and MM. However, some locations may employ a third marker beacon to indicate the point at which the decision height should occur when used with a Category II ILS.

(a) The OM normally indicates a position at which an aircraft at the appropriate altitude on the localizer course will intercept the ILS glide path. The OM is modulated at 400 Hz and identified with continuous dashes at the rate of two dashes per second and a blue marker beacon light.

(b) The MM indicates a position at which an aircraft is approximately 3,500 feet from the landing threshold. This will also be the position at which an aircraft on the glide path will be at an altitude of approximately 200 feet above the elevation of the touchdown zone. The MM is modulated at 1300 Hz and identified with alternate dots and dashes keyed at the rate of 95 dot/dash combinations per minute and an amber marker beacon light.

(c) The inner marker (IM), where installed, will indicate a point at which an aircraft is at a designated decision height (DH) on the glide path between the MM and landing threshold. The IM is modulated at 3000 Hz and identified with continuous dots keyed at the rate of six dots per second and a white marker beacon light.

(3) A back course marker, where installed, normally indicates the ILS back course final approach fix where approach descent is commenced. The back course marker is modulated at 3000 Hz and identified with two dots at a rate of 72 to 95 two dot combinations per minute and a white marker beacon light.

g. COMPASS LOCATOR

(1) Compass locator transmitters are often situated at the MM and OM sites. The transmitters have a power of less than 25 watts, a range of at least 15 miles and operate between 190 and 535 kHz.

NOTE— At some locations, higher powered radio beacons, up to 400 watts, are used as OM compass locators. These generally carry Transcribed Weather Broadcast (TWEB) information.

(2) Compass locators transmit two letter identification groups. The outer locator transmits the first two letters of the localizer identification group, and the middle locator transmits the last two letters of the localizer identification group.

h. ILS FREQUENCY

(1) The following frequency pairs have been allocated for ILS. Although not all of these 40 frequency pairs are being utilized, they will be in the future.

Localizer MHz	Glide Slope MHz
108.10	334.70
108.15	334.55
108.3	334.10
108.35	333.95
108.5	329.90
108.55	329.75
108.7	330.50
108.75	330.35
108.9	329.30
108.95	329.15
109.1	331.40
109.15	331.25
109.3	332.00
109.35	331.85
109.50	332.60
109.55	332.45
109.70	333.20
109.75	333.05
109.90	333.80
109.95	333.65
110.1	334.40
110.15	334.25
110.3	335.00
110.35	334.85
110.5	329.60
110.55	329.45
110.70	330.20
110.75	330.05
110.90	330.80
110.95	330.65
111.10	331.70
111.15	331.55
111.30	332.30
111.35	332.15
111.50	332.9
111.55	332.75
111.70	333.5
111.75	333.35
111.90	331.1
111.95	330.95

i. ILS MINIMUMS

(1) The lowest authorized ILS minimums, with all required ground and airborne systems components operative, are

(a) Category I - Decision Height (DH) 200 feet and Runway Visual Range (RVR) 2,400 feet (with touchdown zone and centerline lighting, RVR 1800 Category A, B, C; RVR 2000 Category D).

(b) Category II - DH 100 feet and RVR 1,200 feet.

(c) Category IIIA - RVR 700 feet.

NOTE— Special authorization and equipment are required for Category II and IIIA.

j. INOPERATIVE ILS COMPONENTS

(1) Inoperative localizer: When the localizer fails, an ILS approach is not authorized.

(2) Inoperative glide slope: When the glide slope fails, the ILS reverts to a nonprecision localizer approach.

NOTE— Refer to the Inoperative Component Table in the U.S. Government IAPs publications, Supplementary Information Section, for adjustments to minimums due to inoperative airborne or ground system equipment.

k. ILS COURSE DISTORTION

(1) All pilots should be aware that disturbance to ILS localizer and glide slope courses may occur when surface vehicles or aircraft are operated near the localizer and glide slope antennas. Antenna locations are such that few ILS installations are not subject to signal interference by either surface vehicles, aircraft or both. ILS CRITICAL AREAS are established on the surface about each localizer and glide slope antenna. Air traffic control (ATC) procedures exist to control the operation of vehicle or aircraft traffic on the portions of taxiways and runways that lie within the critical areas and to adjust the flow of arrival or departure traffic so that the proximity of one aircraft to an ILS antenna does not cause interference to the ILS course signals being used by another when the weather or visibility conditions are below specific values.

(2) ATC issues control instructions to avoid interfering operations within ILS critical areas at controlled airports during the hours the Airport Traffic Control Tower (ATCT) is in operations as follows:

(a) Weather Conditions - At or above ceiling 800 feet and/or visibility 2 miles.

1. No critical area protective action is provided under these conditions

2. If an aircraft advises the TOWER that an AUTOLAND or COUPLED approach will be conducted, an advisory will be promptly issued if a vehicle or aircraft will be in or over a critical area when the arriving aircraft is inside the ILS MM.

EXAMPLE:

GLIDE SLOPE SIGNAL NOT PROTECTED.

(b) Weather Conditions - Less than ceiling 800 feet and/or visibility 2 miles.

1. GLIDE SLOPE CRITICAL AREA - Vehicles and aircraft are not authorized in the area when an arriving aircraft is between the ILS final approach fix and the airport unless the aircraft has reported the airport in sight and is circling or side stepping to land on a runway other than the ILS runway.

2. LOCALIZER CRITICAL AREA - Except for aircraft that may operate in or over the area when landing or exiting a runway or for departures or missed approaches, vehicles and aircraft are not authorized in or over the area when an arriving aircraft is between the ILS final approach fix and the airport. Additionally, when the ceiling is less than 200 feet and/or the visibility is RVR 2,000 or less, vehicle and aircraft operations in or over the area are not authorized when an arriving aircraft is inside the ILS MM.

(3) While a critical area is not specifically established outward from the airport to the final approach fix, an aircraft holding below 5,000 feet AGL inbound toward an airport between the ILS final approach fix and the airport can cause reception of unwanted localizer signal reflections by aircraft conducting an ILS approach. Accordingly, such holding is not authorized when weather or visibility conditions are less than ceiling 800 feet and/or visibility 2 miles.

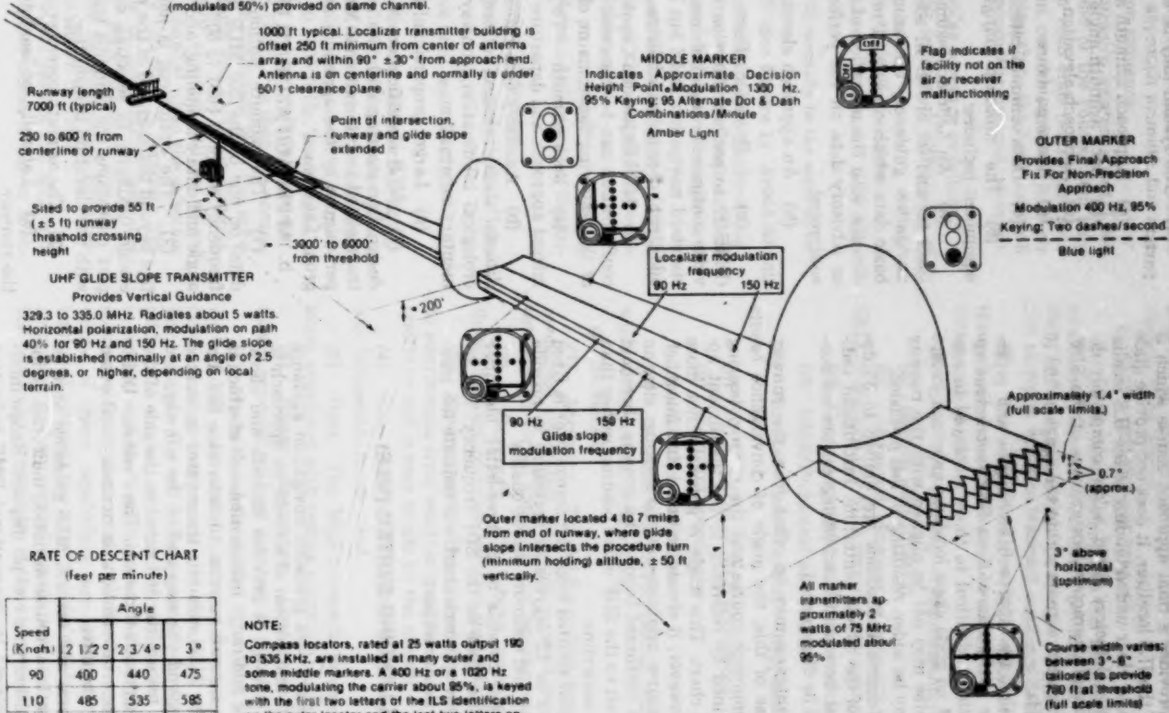
(4) Pilots are cautioned that vehicular traffic not subject to control by ATC may cause momentary deviation to ILS course or glide slope signals. Also, no active protection of critical areas exists at airports without an operational ATCT or at airports with an operational control tower when weather or visibility conditions are above those requiring protective measures. Aircraft conducting coupled or autoland operations should be especially alert in monitoring automatic flight control systems.

ILS

[FAA INSTRUMENT LANDING SYSTEM]

STANDARD CHARACTERISTICS AND TERMINOLOGY

ILS approach charts should be consulted to obtain variations of individuals systems.


Runway length
7000 ft (typical)
250 to 600 ft from centerline of runway
Sited to provide 55 ft (± 5 ft) runway threshold crossing height
Point of intersection, runway and glide slope extended
3000' to 6000' from threshold
*200'
Localizer modulation frequency
90 Hz
150 Hz
90 Hz
150 Hz
Glide slope modulation frequency
Flag indicates if facility not on the air or receiver malfunctioning
Approximately 1.4° width (full scale limits)
0.7° (approx.)
3° above horizontal (optimum)
Course width varies between 3°-6° tailored to provide 700 ft at threshold (full scale limits)

VHF LOCALIZER

Provides Horizontal Guidance.

108.10 to 111.95 MHz. Radiates about 100 watts. Horizontal polarization. Modulation frequencies 90 and 150 Hz. Modulation depth on course 20% for each frequency. Code identification (1020 Hz, 5%) and voice communication (modulated 50%) provided on same channel.

1000 ft typical. Localizer transmitter building is offset 250 ft minimum from center of antenna array and within 90° ± 30° from approach end. Antenna is on centerline and normally is under 50/1 clearance plane.

UHF GLIDE SLOPE TRANSMITTER

Provides Vertical Guidance

329.3 to 335.0 MHz. Radiates about 5 watts. Horizontal polarization, modulation on path 40% for 90 Hz and 150 Hz. The glide slope is established nominally at an angle of 2.5 degrees, or higher, depending on local terrain.

MIDDLE MARKER

Indicates Approximate Decision Height Point. Modulation 1300 Hz, 95% Keying: 95 Alternate Dot & Dash Combinations/Minute

Amber Light

OUTER MARKER

Provides Final Approach Fix For Non-Precision Approach

Modulation 400 Hz, 95%

Keying: Two dashes/second

— — — — — — — — — —

Blue light

Outer marker located 4 to 7 miles from end of runway, where glide slope intersects the procedure turn (minimum holding) altitude, ± 50 ft vertically.

All marker transmitters approximately 2 watts of 75 MHz modulated about 95%

RATE OF DESCENT CHART
(feet per minute)

Speed (Knots)	Angle		
	2 1/2°	2 3/4°	3°
90	400	440	475
110	485	535	585
130	575	630	690
150	665	730	795
160	707	778	849

NOTE:

Compass locators, rated at 25 watts output 190 to 535 KHz, are installed at many outer and some middle markers. A 400 Hz or a 1020 Hz tone, modulating the carrier about 95%, is keyed with the first two letters of the ILS identification on the outer locator and the last two letters on the middle locator. At some locators, simultaneous voice transmissions from the control tower are provided, with appropriate reduction in identification percentage.

* Figures marked with asterisk are typical. Actual figures vary with deviations in distances to markers, glide angles and localizer widths.

13. SIMPLIFIED DIRECTIONAL FACILITY (SDF)

a. The SDF provides a final approach course which is similar to that of the ILS localizer. It does not provide glide slope information. A clear understanding of the ILS localizer and the additional factors listed below completely describe the operational characteristics and use of the SDF.

b. The SDF transmits signals within the range of 108.10 MHz to 111.95 MHz.

c. For the pilot, the approach techniques and procedures used in the performance of an SDF instrument approach are essentially identical to those employed in executing a standard no glide slope localizer approach except that the SDF course may not be aligned with the runway and the course may be wider, resulting in less precision.

d. Usable off-course indications are limited to 35 degrees either side of the course centerline. Instrument indications in the areas between 35 and 90 degrees are not controlled and should be disregarded.

e. The SDF antenna may be offset from the runway centerline. Because of this, the angle of convergence between the final approach course and the runway bearing should be determined by reference to the instrument approach procedure chart. This angle is generally not more than 3 degrees. However, it should be noted that inasmuch as the approach course originates at the antenna site, an approach which is continued beyond the runway threshold will lead the aircraft to the SDF offset position rather than along the runway centerline.

f. The SDF signal emitted from the transmitter is fixed at either 6 degrees or 12 degrees as necessary to provide maximum flyability and optimum course quality.

g. Identification consists of a three-letter identifier transmitted in Morse Code on the SDF frequency. The appropriate instrument approach chart will indicate the identifier used at a particular airport.

14. MICROWAVE LANDING SYSTEM (MLS)

a. GENERAL

(1) The MLS provides precision navigation guidance for exact alignment and descent of aircraft on approach to and landing on a runway. It provides azimuth and elevation angle guidance and range information—all of which is interpreted by the aircraft receiver to determine the aircraft's position. The MLS azimuth transmitter is located about 1,000 feet beyond the stop end of the runway, and the MLS elevation transmitter is located to the side of the runway near the approach threshold. The Precision DME, which provides range information, is normally collocated with the azimuth transmitter.

(2) Both lateral and vertical MLS guidance may be displayed on conventional course deviation indicators or incorporated into multipurpose cockpit displays. Range information can be displayed by conventional DME indicators and also incorporated into multipurpose displays.

(3) The MLS will initially supplement and eventually replace ILS as the standard landing system in the United States for both civil and military use—and also for international civil aviation. The MLS transition plan assures duplicate ILS and MLS facilities where needed to protect current users of ILS. At international airports ILS service is protected to the year 1995.

(4) The system may be divided functionally into five parts:

(a) Approach azimuth angle guidance.

(b) Back azimuth angle guidance.

(c) Approach elevation angle guidance.

(d) Range guidance.

(e) Data communications.

(5) The *standard configuration* of the MLS ground equipment includes:

(a) An approach azimuth station to perform functions (a) and (e) above. In addition to providing azimuth navigation guidance, the azimuth station also transmits basic data which consists of information that is associated directly with the operation of the landing system, as well as advisory data on the performance level of the ground equipment.

(b) An approach elevation station to perform function (c) above.

(c) Precision Distance Measuring Equipment (DME/P) to perform function (d) above. The DME/P provides continuous range information that is compatible with standard navigation DME but has improved accuracy and additional channel capabilities.

(6) MLS Expansion Capabilities — The standard MLS configuration can be expanded by addition of one or more of the following functions or characteristic improvements:

(a) Back azimuth — To provide lateral guidance for missed approach and departure navigation.

(b) Auxiliary data transmissions — To provide *additional* data, including refined airborne positioning, meteorological information, runway status, and other supplementary information.

(c) Larger proportional guidance.

(7) MLS identification is a four-character alphabetic designation starting with the letter M. This designation is transmitted in International Morse Code at least six times per minute by the approach azimuth (and back azimuth) ground equipment.

b. APPROACH AZIMUTH GUIDANCE

(1) The azimuth station transmits MLS angle (and data) on one of the 200 MLS channels within the C-band frequency range of 5031 to 5091 MHz. See Table 1 for MLS angle and data channeling, and Table 2 for the DME.

(2) The equipment is normally located about 1,000 feet beyond the stop end of the runway, but there is considerable flexibility in selecting sites. For example, for heliport operations the azimuth transmitter can be collocated with the elevation transmitter.

(3) The azimuth coverage (see Figure 1) extends:

(a) Laterally, at least 40 degrees on either side of the runway.

(b) In elevation, up to an angle of 15 degrees — and to at least 20,000 feet.

(c) In range, to a distance of at least 20 NM.

c. BACK AZIMUTH GUIDANCE (See Figure 1)

(1) The back azimuth transmitter is essentially the same as the approach azimuth transmitter. However, the equipment transmits at a somewhat lower data rate because the guidance accuracy requirements are not as stringent as for the landing approach. The equipment operates on the same frequency as the approach azimuth but at a different time in the transmission sequence.

(2) The equipment is normally located about 1,000 feet in front of the approach end of the runway. On runways that have MLS service on both ends (e.g., Runway 9 and 27), the azimuth equipment can be switched in their operation from the approach azimuth to the back azimuth and vice versa, and thereby reduce the amount of equipment required.

(3) The back azimuth provides coverage as follows:

(a) Laterally, at least 40 degrees on either side of the runway.

(b) In elevation, up to an angle of 15 degrees.

(c) In range, to a distance of at least 7 NM from the runway stop end.

NOTE— The actual coverage will normally be the same as for the approach azimuth.

d. ELEVATION GUIDANCE (See Figure 1)

(1) The elevation station transmits its guidance signals on the same carrier frequency as the azimuth station. A single frequency is time-shared between all angle and data functions.

(2) The elevation transmitter is normally located about 400 feet on either side of the runway between runway threshold and the touchdown zone.

(3) Elevation coverage is provided in the approach region throughout the same volume of airspace as the azimuth guidance signals, namely:

(a) In elevation, to at least +15 degrees.

(b) Laterally, 40 degrees on either side of the runway.

(c) In range, to a distance of at least 20 NM.

e. RANGE GUIDANCE

(1) The MLS Precision Distance Measuring Equipment (DME/P) is the same in function as the navigation DME described in PARA. 7, but there are some technical differences. It consists of a beacon transponder that operates in the frequency band 962 to 1105 MHz. It responds to a beacon interrogation made by an aircraft interrogator. The main change with the MLS DME/P is that the accuracy has been improved so as to be consistent with the accuracy provided by the MLS azimuth and elevation stations.

(2) In operation, a DME/P channel will be paired with the azimuth and elevation channel when the selection of a particular MLS is made by the pilot. A complete listing of the 200 paired channels of the DME/P with the angle functions is contained in FAA Standard 022 (MLS Interoperability and Performance Requirements). For illustrative purposes the first page is shown in Table 2.

(3) The DME/P is an integral part of the MLS and will be installed at all MLS facilities unless a waiver is obtained. It is intended that this will occur infrequently — and only at outlying, low density airports where marker beacons or compass locators are already in place at the runway to be served.

f. DATA COMMUNICATIONS

(1) The data transmission can include both basic and auxiliary data words. All MLS facilities will transmit basic data. In the future some airports, including most high density airports, will also transmit auxiliary data.

(2) Coverage limits — MLS data are transmitted throughout the azimuth (and back azimuth when provided) coverage sectors.

(3) Basic data content — Representative data include:

(a) Station identification.

(b) Surveyed locations of azimuth, elevation and DME/P stations (for MLS receiver processing functions).

(c) Ground equipment performance level.

(d) DME/P channel and status.

(4) Auxiliary data content — Representative data include:

(a) 3-D locations of MLS equipment.

(b) Waypoint coordinates.

(c) Runway conditions.

(d) Weather (e.g., RVR, ceiling, altimeter setting, wind, wake vortex, wind shear).

g. SUMMARY

(1) Accuracy. The MLS provides precision three-dimensional navigation guidance — guidance that is accurate enough for all approach and landing maneuvers.

(2) Coverage. The above accuracy is provided throughout the coverage volumes shown in Figure 1.

(3) Environment. The system has low susceptibility to interference from weather conditions and airport ground traffic — and is easy to site on the airport.

(4) Channels. MLS has 200 channels — enough for any foreseeable future need.

(5) Data. The MLS transmits ground-air data messages associated with system operation.

(6) Range information. Continuous range information is provided with an accuracy of about 100 feet.

(7) Operational flexibility. The MLS has the capability to fulfill a variety of needs in the transition, approach, landing, missed approach and departure phases of flight. For example: Curved and segmented approaches; selectable glide path angles; accurate 3-D positioning of the aircraft in space; and the establishment of boundaries to ensure clearance from obstructions in the terminal area. While many of these capabilities are available to any MLS-equipped aircraft, the more sophisticated capabilities (such as curved and segmented approaches) are dependent upon the particular capabilities of the airborne equipment.

496-568 0 - 85 - 2

Table 1. MLS Channeling

(Azimuth, Elevation, & Data)

CHANNEL NUMBER	FREQUENCY (MHz)	CHANNEL NUMBER	FREQUENCY (MHz)	CHANNEL NUMBER	FREQUENCY (MHz)	CHANNEL NUMBER	FREQUENCY (MHz)	CHANNEL NUMBER	FREQUENCY (MHz)
500	5031.0	540	5043.0	580	5055.0	620	5067.0	660	5079.0
501	5031.3	.	.	.	.	.	.	.	.
502	5031.6	.	.	.	.	.	.	.	.
503	5031.9	.	.	.	.	.	.	.	.
504	5032.2	.	.	.	.	.	.	.	.
505	5032.5	545	5044.5	585	5056.5	625	5068.5	665	5080.5
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
510	5034.0	550	5046.0	590	5058.0	630	5070.0	670	5082.0
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
515	5035.5	555	5047.5	595	5059.5	635	5071.5	675	5083.5
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
520	5037.0	560	5049.0	600	5061.0	640	5073.0	680	5085.0
.	.	.	.	.	.	.	.	.	.
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.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
525	5038.5	565	5050.5	605	5062.5	645	5074.5	685	5086.5
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
530	5040.0	570	5052.0	610	5064.0	650	5076.0	690	5088.0
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
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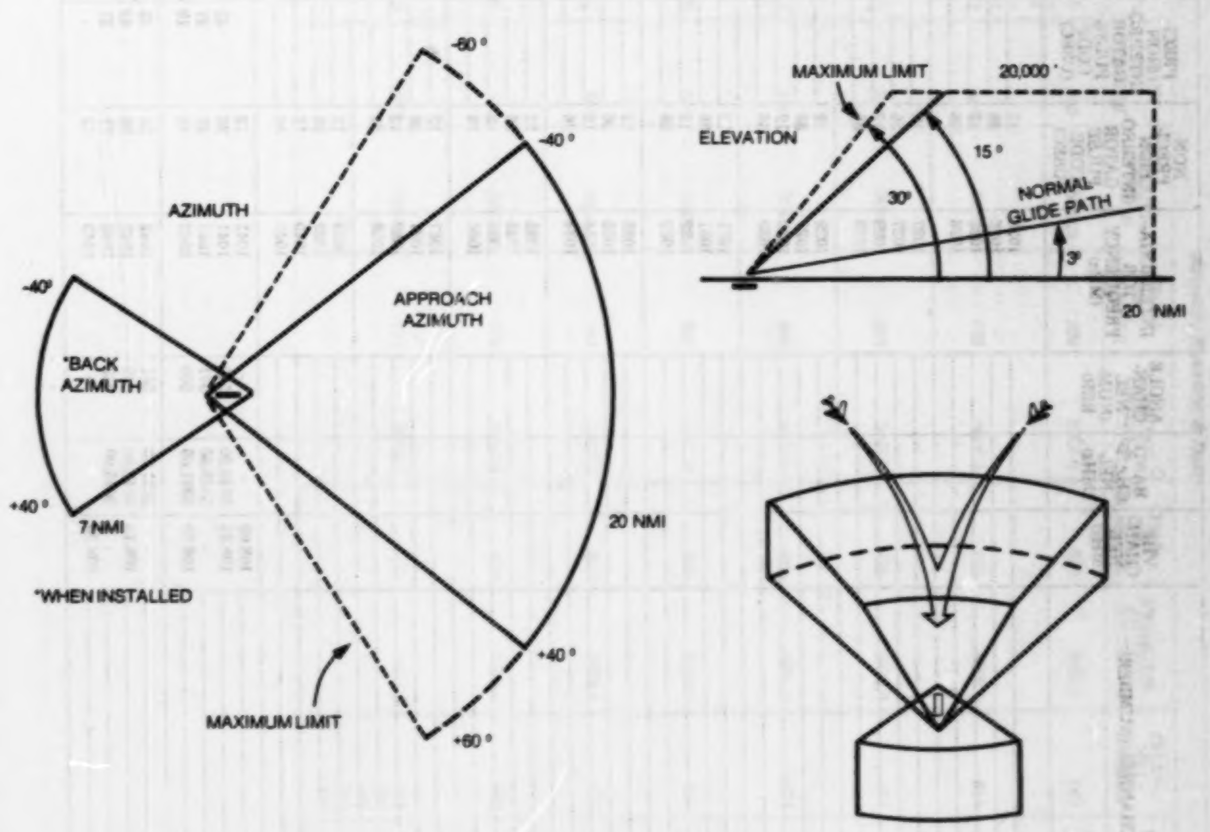
535	5041.5	575	5053.5	615	5065.5	655	5077.5	695	5089.5
.	.	.	.	.	.	.	.	696	5089.8
.	.	.	.	.	.	.	.	697	5090.1
.	.	.	.	.	.	.	.	698	5090.4
.	.	.	.	.	.	.	.	699	5090.7

Table 2. DME/P Channels, Frequencies, and Pairings

DME CHANNEL (NUMBER)	VHF CHANNEL (MHz)	C-BAND CHANNEL (MHz)	ANGLE CHANNEL (NUMBER)	INTERROGATOR FREQUENCY (MHz)	NON-PRECISION INTERROGATOR PULSE CODE (USEC)	PRECISION INTERROGATOR PULSE CODE (USEC)	TRANSPONDER FREQUENCY (MHz)	TRANSPONDER PULSE CODE (USEC)
1X				1025	12		962	12
1Y				1025	36		1088	30
2X				1026	12		963	12
2Y				1026	36		1089	30
3X				1027	12		964	12
3Y				1027	36		1090	30
4X				1028	12		965	12
4Y				1028	36		1091	30
5X				1029	12		966	12
5Y				1029	36		1092	30
6X				1030	12		967	12
6Y				1030	36		1093	30
7X				1031	12		968	12
7Y				1031	36		1094	30
8X				1032	12		969	12
8Y				1032	36		1095	30
9X				1033	12		970	12
9Y				1033	36		1096	30
10X				1034	12		971	12
10Y				1034	36		1097	30
11X				1035	12		972	12
11Y				1035	36		1098	30
12X				1036	12		973	12
12Y				1036	36		1099	30
13X				1037	12		974	12
13Y				1037	36		1100	30
14X				1038	12		975	12
14Y				1038	36		1101	30
15X				1039	12		976	12
15Y				1039	36		1102	30
16X				1040	12		977	12
16Y				1040	36		1103	30
17X	108.00	-	-	1041	12	-	978	12
17Y	108.05	5043.00	540	1041	36	42	1104	30
17Z	-	5043.30	541	1041	21	27	1104	15
18X	108.10	5031.00	500	1042	12	18	979	12
18W	-	5031.30	501	1042	24	33	979	24
18Y	108.15	5043.60	542	1042	36	42	1105	30
18Z	-	5043.90	543	1042	21	27	1105	15
19X	108.20	-	-	1043	12	-	980	12

Figure 1.

COVERAGE VOLUMES


MAXIMUM LIMIT
20,000 '
ELEVATION
15 °
30°
NORMAL GLIDE PATH
3°
20 NMI
AZIMUTH
-60 °
-40 °
APPROACH AZIMUTH
-40°
*BACK AZIMUTH
+40 °
7 NMI
20 NMI
+40 °
+60 °
MAXIMUM LIMIT
*WHEN INSTALLED

15. INTERIM STANDARD MICROWAVE LANDING SYSTEM (ISMLS)

a. The ISMLS is designed to provide approach information similar to the ILS for an aircraft on final approach to a runway. The system provides both lateral and vertical guidance which is displayed on a conventional course deviation indicator or approach horizon. Operational performance and coverage areas are similar to the ILS system.

b. ISMLS operates in the C-band microwave frequency range (about 5000 MHz). ISMLS signals will not be received by unmodified VHF/UHF ILS receivers. Aircraft utilizing ISMLS must be equipped with a C-band receiving antenna in addition to other special equipment mentioned below. The receiving aperture of the C-band antenna limits reception of the signal to an angle of about 50 degrees from the inbound course. Therefore, an aircraft so equipped will not receive the ISMLS signal until flying a magnetic heading within 50 degrees either side of the inbound course. Because of this ISMLS procedures are designed to preclude use of the ISMLS signal until the aircraft is in position for the final approach. Transition to the ISMLS, holding and procedure turns at the ISMLS facility must be predicated on other navigation aids such as NDB, VOR, etc. Once established on the approach course inbound, the system can be flown identical to ILS. No back course is provided.

c. The ISMLS consists of the following basic components:

(1) C-Band (5000 MHz-5030 MHz) localizer.

(2) C-Band (5220 MHz-5250 MHz) glide path.

(3) VHF marker beacons (75 MHz).

(4) A VHF/UHF ILS receiver modified to be capable of receiving the ISMLS signals.

(5) C-Band antenna.

(6) Converter unit.

(7) A Microwave/ILS Mode Control.

d. The identification consists of a three letter Morse Code identifier preceded by the Morse Code for "M" (- -) (e.g., M—STP). The "M" will distinguish this system from ILS which is preceded by the Morse Code for "I" (..) (e.g., I-STP).

e. Approaches published in conjunction with the ISMLS will be identified as "MLS Rwy—(Interim)." The frequency displayed on the ISMLS approach chart will be a VHF frequency. ISMLS frequencies are tuned by setting the receiver to the listed VHF frequencies. When the ISMLS mode is selected, receivers modified to accept ISMLS signals will not receive the VHF/UHF frequency but a paired LOC/GS C-band frequency that will be processed by the receiver.

CAUTION: Aircraft not equipped for ISMLS operation should not attempt to fly ISMLS procedures.

16. MAINTENANCE OF FAA NAVAIDS

During periods of routine or emergency maintenance, the coded identification (or code and voice, where applicable) will be removed from certain FAA NAVAIDs; namely, ILS localizers, VHF ranges, NDBs, compass locators and 75 MHz marker beacons. The removal of identification serves as warning to pilots that the facility has been officially taken over by "Maintenance" for tune-up or repair and may be unreliable even though intermittently or constantly on the air.

NOTE- During periods of maintenance VHF ranges may radiate a T-E-S-T code (— ● ●●● —).

17. NAVAIDS WITH VOICE

a. Voice equipped en route radio navigational aids are under the operational control of either an FAA FSS or an approach control facility. Most NAVAIDs are remotely operated.

b. Unless otherwise noted on the chart, all radio navigation aids operate continuously except during interruptions for voice transmissions on the same frequencies where simultaneous transmission is not available, and during shutdowns for maintenance purposes. Hours of operation of those facilities not operating continuously are annotated on charts and in the Airport/Facility Directory.

18. RESERVED

19. USER REPORTS ON NAVAID PERFORMANCE

a. Users of the National Airspace System (NAS) can render valuable assistance in the early correction of NAVAID malfunctions by reporting their observations of undesirable NAVAID performance. Although the NAVAID is monitored by electronic detectors within the equipment or in the field of radiation near the antenna, adverse effects of electronic interference, new obstructions or changes in terrain near the NAVAID can exist without detection by the ground monitors. Some of the characteristics of malfunction or deteriorating performance which should be reported are: erratic course or bearing indications; intermittent, or full, flag alarm; garbled, missing or obviously improper coded identification; poor quality communications reception; or, in the case of frequency interference, an audible hum or tone accompanying radio communications or NAVAID identification.

b. User reports should identify the NAVAID, location of the aircraft, time of the observation and type of aircraft and describe the condition observed; the type of receivers in use will also be useful information. User reports can be made in any of the following ways:

(1) Immediate report by direct radio communication to the controlling Air Route Traffic Control Center (ARTCC), Control Tower, or FSS. This method will provide the most timely resolution of the reported condition.

(2) Report by telephone to the nearest FAA facility.

(3) Report by FAA Form 8000-7, Safety Improvement Report. This is a self addressed, postage-paid card designed with this purpose in mind. A supply of these cards may be found at FAA FSSs, General Aviation District Offices and General Aviation Fixed Base Operations.

c. In complex aircraft radio installations involving more than one receiver, there are many combinations of possible interference between units. This interference can cause either erroneous navigation indications, or complete or partial blanking out of the communications. Pilots should be familiar enough with the radio installation of the particular airplanes they fly to recognize this type of interference.

20. LORAN

LORAN-A service has been terminated in the U.S. coastal confluence region. Prerecorded telephone answering service messages pertaining to LORAN-C operatio are available as follows:

RATE	CHAIN	TELEPHONE
5930	Canadian East Coast	709-454-3261*
7980	Southeast U.S.	904-569-5241
8970	Great Lakes	607-869-5395
9960	Northeast U.S.	607-869-5395

*St. Anthony, Newfoundland, Canada

Additional information can be obtained directly from the office of the Coordinator of Chain Operations (COCO) for each chain. The following telephone numbers are f each COCO office:

RATE	CHAIN	TELEPHONE	LOCATION
5930	Canadian East Coast	709-454-2392	St. Anthony, Nfld.
7980	Southeast U.S.	904-569-2223	Malone, FL
8970	Great Lakes	607-869-5393	Seneca, NY
9960	Northeast U.S.	607-869-5393	Seneca, NY
4990	Central Pacific	808-247-5591	Kaneohe, HI
5990	Canadian West Coast	707-987-2911	Middletown, CA
7960	Gulf of Alaska	907-487-5583	Kodiak, AK
9940	U.S. West Coast	707-987-2911	Middletown, CA
9970	Northwest Pacific	415-273-4393	San Francisco, CA
9990	North Pacific	907-487-5583	Kodiak, AK
7930	North Atlantic	011-44-1-409-4415	London, U.K.
7970	Norwegian Sea	011-44-1-409-4415	London, U.K.
7990	Mediterranean Sea	011-44-1-409-4415	London, U.K.

21. OMEGA AND OMEGA/VLF NAVIGATION SYSTEMS

a. OMEGA

(1) OMEGA is a network of eight transmitting stations located throughout the world to provide worldwide signal coverage. These stations transmit a phase stable 10 kW signal in the Very Low Frequency (VLF) band. Because of the low frequency, the signals are receivable to ranges of thousands of miles. The eight stations are located in Norway, Liberia, Hawaii, North Dakota (USA), La Reunion, Argentina, Australia, and Japan.

(2) Presently each station transmits on four basic navigational frequencies: 10.2 kHz, 11.05 kHz, 11.3 kHz, and 13.6 kHz, in sequenced format. This time sequenced format prevents interstation signal interference. With eight stations and a silent .2-second interval between each transmission, the entire cycle repeats every 10 seconds.

(3) In addition to the four basic navigational frequencies, each station transmits a unique navigation frequency. An OMEGA station is said to be operating in full format when the station is transmitting on the basic frequencies plus the unique frequency. Unique frequencies are prese ly assigned as follows:

STATION	LOCATION	FREQUENC
Station A	Norway	12.1 kHz
Station B	Liberia	12.0 kHz
Station C	Hawaii	11.8 kHz
Station D	North Dakota	13.1 kHz
Station E	La Reunion	12.3 kHz
Station F	Argentina	12.9 kHz
Station G	Australia	13.0 kHz
Station H	Japan	12.8 kHz

b. VLF

(1) The U.S. Navy operates a communications syst in the VLF band. The transmitting stations are loca worldwide and transmit at powers of 500-1000 kW. So airborne OMEGA receivers have the capability to rece and process these VLF signals for navigation in addition

OMEGA signals. The VLF stations generally used for navigation are located in Australia, Japan, England, Hawaii and in the U.S. in Maine, Washington and Maryland (Annapolis).

(2) Although the Navy does not object to the use of VLF communications signals for navigation, the system is not dedicated to navigation. Signal format, transmission, and other parameters of the VLF system are subject to change at the Navy's discretion. The VLF communications stations are individually shut down for scheduled maintenance for a few hours each week. Regular NOTAM service regarding the VLF system or station status is not available. However, the Naval Observatory provides a taped message concerning phase differences, phase values, and shutdown information for both the VLF communications network and the OMEGA system (phone 202-653-1757).

c. Operational Use of OMEGA and OMEGA/VLF

(1) Experience has shown that the OMEGA navigation network is capable of providing consistent fixing information to an accuracy of plus or minus 2 NM depending upon the level of sophistication of the receiver/processing system. OMEGA signals are affected by propagation variables which may degrade fix accuracy. These variables include diurnal variation of phase velocity, polar cap absorption, and sudden ionospheric disturbances (solar activity). Although the diurnal variation can be compensated for within the receiver/processor, occasional excessive solar activity and its effect on OMEGA cannot be completely forecast or anticipated. If an unusual amount of solar activity disturbs the OMEGA signal propagation paths to any extent, the U.S. Coast Guard advises the FAA and an appropriate NOTAM is promulgated.

(2) At 16 minutes past each hour, WWV (Fort Collins, Colorado) broadcasts a message concerning the status of each OMEGA station, signal anomalies, and other information concerning OMEGA. At 47 minutes past each hour, WWVH (Hawaii) broadcasts similar information. The U.S. Coast Guard provides a taped OMEGA status report (202-245-0298). NOTAMS concerning OMEGA are available through any FSS. It is recommended that OMEGA NOTAMs be requested by OMEGA station name.

(3) The FAA has recognized OMEGA and OMEGA/VLF systems as an additional, but not the sole, means of en route IFR navigation in the conterminous United States and Alaska when approved in accordance with FAA guidance information. Use of OMEGA or OMEGA/VLF requires that all navigation equipment otherwise required by the Federal Aviation Regulations be installed and operating. When flying RNAV routes, VOR and DME are required to be installed.

(4) The FAA does not recognize the use of the Naval VLF communications system as a sole means of navigation. VLF communications signals may be used to supplement OMEGA navigation if the equipment is capable of reverting to OMEGA only for navigation.

22. VHF DIRECTION FINDER

a. The VHF Direction Finder (VHF/DF) is one of the common system equipments that helps the pilot without his being aware of its operation. The VHF/DF is a ground based radio receiver used by the operator of the ground station where it is located. FAA facilities having capability to provide VHF/DF service are identified in the Airport/Facility Directory.

b. The equipment consists of a directional antenna system and a VHF radio receiver. At a radar equipped tower or center, the cathode ray tube indications may be superimposed on the radarscope.

c. The VHF/DF display indicates the magnetic direction of the aircraft from the station each time the aircraft transmits. Where DF equipment is tied into radar, a strobe of light is flashed from the center of the radarscope in the direction of the transmitting aircraft.

d. DF equipment is of particular value in locating lost aircraft and in helping to identify aircraft on radar. (See PARA. 452 - DIRECTION FINDING INSTRUMENT APPROACH PROCEDURE.)

23—29. RESERVED

NOTES

Section 2. RADAR SERVICES AND PROCEDURES

30. RADAR

a. Capabilities

(1) Radar is a method whereby radio waves are transmitted into the air and are then received when they have been reflected by an object in the path of the beam. *Range* is determined by measuring the time it takes (at the speed of light) for the radio wave to go out to the object and then return to the receiving antenna. The *direction* of a detected object from a radar site is determined by the position of the rotating antenna when the reflected portion of the radio wave is received.

(2) More reliable maintenance and improved equipment have reduced radar system failures to a negligible factor. Most facilities actually have some components duplicated-one operating and another which immediately takes over when a malfunction occurs to the primary component.

b. Limitations

(1) It is very important for the aviation community to recognize the fact that there are limitations to radar service and that ATC controllers may not always be able to issue traffic advisories concerning aircraft which are not under ATC control and cannot be seen on radar.

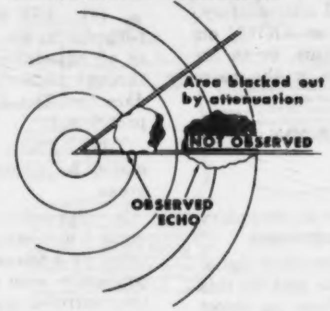
(a) The characteristics of radio waves are such that they normally travel in a continuous straight line unless they are:

1. "Bent" by abnormal atmospheric phenomena such as temperature inversions;

2. Reflected or attenuated by dense objects such as heavy clouds, precipitation, ground obstacles, mountains, etc.; or

3. Screened by high terrain features.

Precipitation Attenuation



The nearby target absorbs and scatters so much of the out-going and returning energy that the radar does not detect the distant target.

(b) The bending of radar pulses, often called anomalous propagation or ducting, may cause many extraneous blips to appear on the radar operator's display if the beam has been bent toward the ground or may decrease the detection range if the wave is bent upward. It is difficult to solve the effects of anomalous propogation, but using beacon radar and electronically eliminating stationary and slow moving targets by a method called moving target indicator (MTI) usually negate the problem.

(c) Radar energy that strikes dense objects will be reflected and displayed on the operator's scope thereby blocking out aircraft at the same range and greatly weakening or completely eliminating the display of targets at a greater range. Again, radar beacon and MTI are very effectively used to combat ground clutter and weather phenomena, and a method of circularly polarizing the radar beam will eliminate some weather returns. A negative characteristic of MTI is that an aircraft flying a speed that coincides with the canceling signal of the MTI (tangential or "blind" speed) may not be displayed to the radar controller.

(d) Relatively low altitude aircraft will not be seen if they are screened by mountains or are below the radar beam due to earth curvature. The only solution to screening is the installation of strategically placed multiple radars which has been done in some areas.

(e) There are several other factors which affect radar control. The amount of reflective surface of an aircraft will determine the size of the radar return. Therefore, a small light airplane or a sleek jet fighter will be more difficult to see on radar than a large commercial jet or

military bomber. Here again, the use of radar beacon is invaluable if the aircraft is equipped with an airborne transponder. All ARTCC radars in the conterminous U.S. and many airport surveillance radars have the capability to interrogate MODE C and display altitude information to the controller from appropriately equipped aircraft. However, there are a number of airport surveillance radars that are still two dimensional (range and azimuth) only and altitude information must be obtained from the pilot.

(f) At some locations within the ATC en route environment, secondary-radar-only (no primary radar) gap filler radar systems are used to give lower altitude radar coverage between two larger radar systems, each of which provides both primary and secondary radar coverage. In those geographical areas served by secondary-radar only, aircraft without transponders cannot be provided with radar service. Additionally, transponder equipped aircraft cannot be provided with radar advisories concerning primary targets and weather. (See RADAR/RADIO DETECTION AND RANGING in the Pilot/Controller Glossary.)

(g) The controllers' ability to advise a pilot flying on instruments or in visual conditions of his proximity to another aircraft will be limited if the unknown aircraft is not observed on radar, if no flight plan information is available, or if the volume of traffic and workload prevent his issuing traffic information. The controller's first priority is given to establishing vertical, lateral, or longitudinal separation between aircraft flying IFR under the control of ATC.

c. FAA radar units operate continuously at the locations shown in the Airport/Facility Directory, and their services are available to all pilots, both civil and military. Contact the associated FAA control tower or ARTCC on any frequency guarded for initial instructions, or in an emergency, any FAA facility for information on the nearest radar service.

31. AIR TRAFFIC CONTROL RADAR BEACON SYSTEM (ATCRBS)

a. The ATCRBS, sometimes referred to as secondary surveillance radar, consists of three main components:

(1) Interrogator. Primary radar relies on a signal being transmitted from the radar antenna site and for this signal to be reflected or "bounced back" from an object (such as an aircraft). This reflected signal is then displayed as a "target" on the controller's radarscope. In the ATCRBS, the *Interrogator,* a ground based radar beacon transmitter-receiver, scans in synchronism with the primary radar and transmits discrete radio signals which repetitiously requests all transponders, on the mode being used, to reply. The replies received are then mixed with the primary returns and both are displayed on the same radarscope.

(2) Transponder. This airborne radar beacon transmitter-receiver automatically receives the signals from the interrogator and selectively replies with a specific pulse group (code) only to those interrogations being received on the mode to which it is set. These replies are independent of, and much stronger than a primary radar return.

(3) Radarscope. The radarscope used by the controller displays returns from both the primary radar system and the ATCRBS. These returns, called targets, are what the controller refers to in the control and separation of traffic.

b. The job of identifying and maintaining identification of primary radar targets is a long and tedious task for the controller. Some of the advantages of ATCRBS over primary radar are:

(1) Reinforcement of radar targets.

(2) Rapid target identification.

(3) Unique display of selected codes.

c. A part of the ATCRBS ground equipment is the decoder. This equipment enables the controller to assign discrete transponder codes to each aircraft under his control. Normally only one code will be assigned for the entire flight. Assignments are made by the ARTCC computer on the basis of the National Beacon Code Allocation Plan. The equipment is also designed to receive MODE C altitude information from the aircraft.

NOTE.— Refer to figures with explanatory legends for an illustration of the target symbology depicted on radar scopes in the NAS Stage A (en route), the ARTS III (terminal) systems, and other nonautomated (broadband) radar systems.

d. It should be emphasized that aircraft transponders greatly improve the effectiveness of radar systems. (See PARA—170 - TRANSPONDER OPERATION.)

32. SURVEILLANCE RADAR

a. Surveillance radars are divided into two general categories: Airport Surveillance Radar (ASR) and Air Route Surveillance Radar (ARSR).

(1) ASR is designed to provide relatively short-range coverage in the general vicinity of an airport and to serve as an expeditious means of handling terminal area traffic through observation of precise aircraft locations on a radarscope. The ASR can also be used as an instrument approach aid.

(2) ARSR is a long-range radar system designed primarily to provide a display of aircraft locations over large areas.

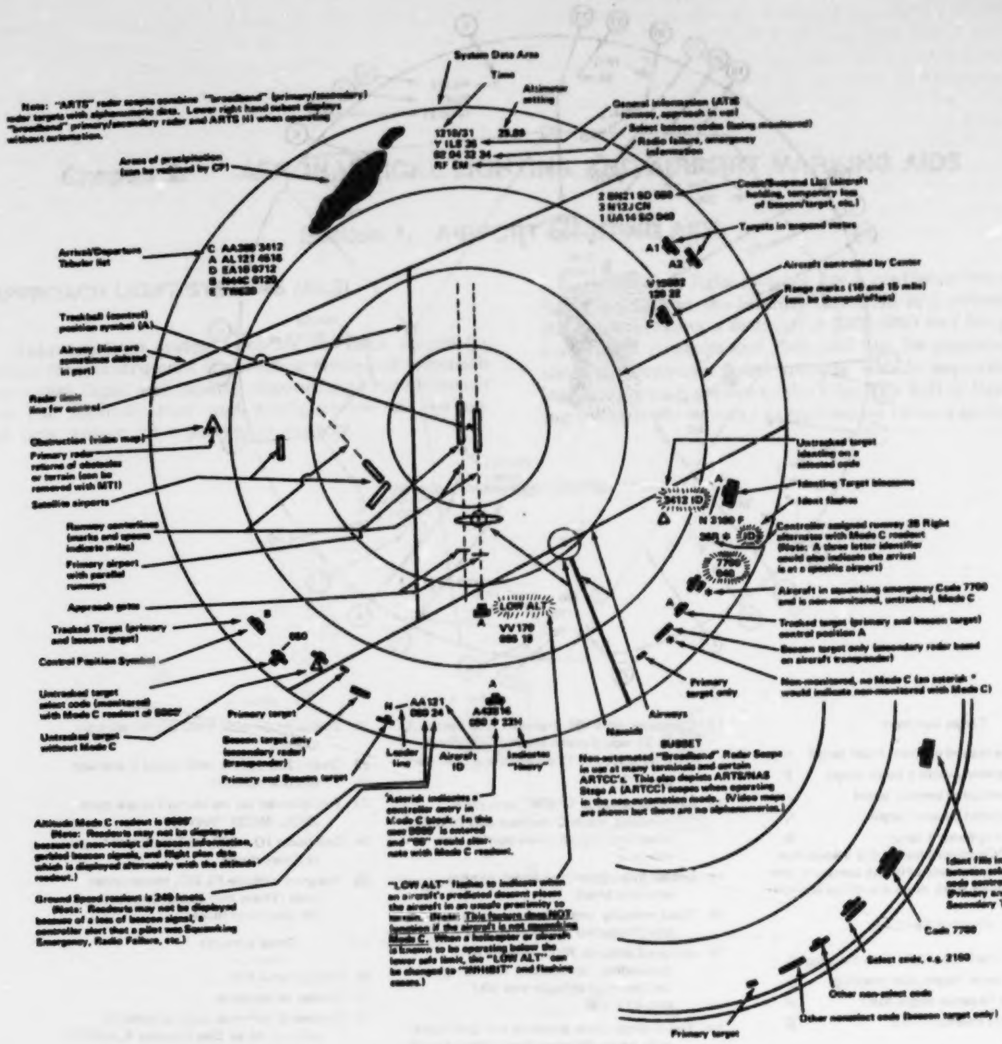
b. Surveillance radars scan through 360 degrees of azimuth and present target information on a radar display located in a tower or center. This information is used independently or in conjunction with other navigational aids in the control of air traffic.

33. PRECISION APPROACH RADAR (PAR)

a. PAR is designed to be used as a *landing aid,* rather than an aid for sequencing and spacing aircraft. PAR equipment may be used as a primary landing aid, or it may be used to monitor other types of approaches. It is designed to display *range, azimuth* and *elevation* information.

b. Two antennas are used in the PAR array, one scanning a vertical plane, and the other scanning horizontally. Since the range is limited to 10 miles, azimuth to 20 degrees, and elevation to 7 degrees, only the final approach area is covered. Each scope is divided into two parts. The upper half presents altitude and distance information, and the lower half presents azimuth and distance.

34—39. RESERVED


System Data Area
Time
Altimeter setting
1210/31
29.89
Y ILS 36
02 04 22 34
RF EM
General information (ATIS runway, approach in use)
Select beacon codes (being monitored)
Radio failure, emergency information
Areas of precipitation (can be reduced by CP)
Coast/Suspend List (aircraft holding, temporary loss of beacon/target, etc.)
2 BN21 SD 080
3 N12J CN
1 UA14 SD 040
Targets in suspend status
A1
A2
Aircraft controlled by Center
V 10882
120 22
C
Range marks (10 and 15 miles) (can be changed/offset)
Arrival/Departure Tabular list
C AA365 3412
A AL121 4616
D EA10 0712
B N44C 0120
E TW620
Trackball (control) position symbol (A)
Airway (lines are sometimes deleted in part)
Radar limit line for control
Obstruction (video map)
Primary radar returns of obstacles or terrain (can be removed with MTI)
Satellite airports
Runway centerlines (marks and spaces indicate miles)
Primary airport with parallel runways
Approach gates
Tracked Target (primary and beacon target)
Control Position Symbol
080
Untracked target select code (monitored) with Mode C readout of 5000'
Untracked target without Mode C
Primary target
Beacon target only (secondary radar) (transponder)
Primary and Beacon target
Untracked target identing on a selected code
Identing Target blossoms
Ident flashes
3412 ID
A
N 3100 F
36R ✱ ID
Controller assigned runway 36 Right alternates with Mode C readout (Note: A three letter identifier could also indicate the arrival is at a specific airport)
7700
040
Aircraft in squawking emergency Code 7700 and is non-monitored, untracked, Mode C
Tracked target (primary and beacon target) control position A
Beacon target only (secondary radar based on aircraft transponder)
Non-monitored, no Mode C (an asterisk * would indicate non-monitored with Mode C)
Primary target only
LOW ALT
VV170
080 18
H
AA121
060 24
A
A43216
050 ✱ 22H
Leader line
Aircraft ID
Indicates "Heavy"
Navaids
Airways
Ident fills in between select code control slashes (Primary and Secondary Target)
Code 7700
Select code, e.g. 2100
Other non-select code
Other nonselect code (beacon target only)
Primary target

Note: "ARTS" radar scopes combine "broadband" (primary/secondary) radar targets with alphanumeric data. Lower right hand subset displays "broadband" primary/secondary radar and ARTS III when operating without automation.

Altitude Mode C readout is 6000'
(Note: Readouts may not be displayed because of non-receipt of beacon information, garbled beacon signals, and flight plan data which is displayed alternately with the altitude readout.)

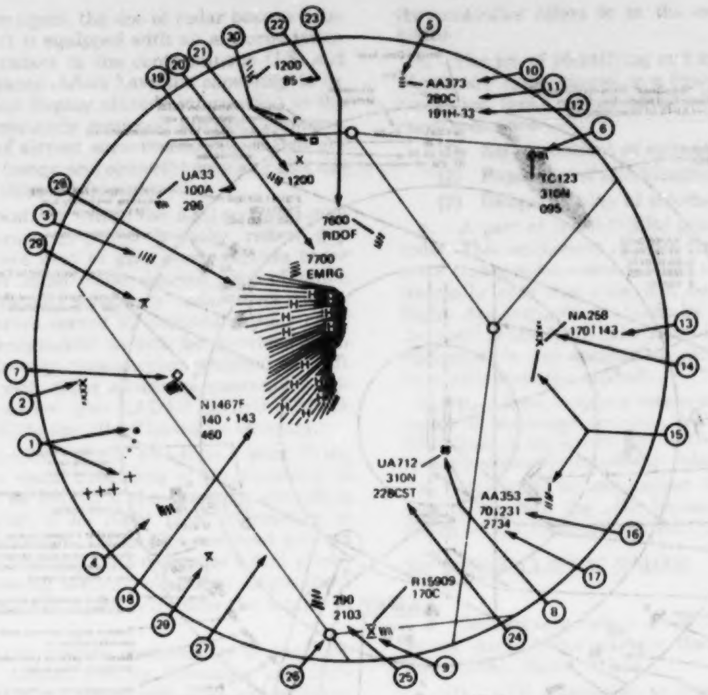
Ground Speed readout is 240 knots.
(Note: Readouts may not be displayed because of a loss of beacon signal, a controller alert that a pilot was Squawking Emergency, Radio Failure, etc.)

*Asterisk indicates a controller entry in Mode C block. In this case 5000' is entered and "05" would alternate with Mode C readout.

"LOW ALT" flashes to indicate when an aircraft's predicted descent places the aircraft in an unsafe proximity to terrain. (Note: This feature does NOT function if the aircraft is not squawking Mode C. When a helicopter or aircraft is known to be operating below the lower safe limit, the "LOW ALT" can be changed to "INHIBIT" and flashing ceases.)

SUBSET
Non-automated "Broadband" Radar Scope in use at many terminals and certain ARTCC's. This also depicts ARTS/NAS Stage A (ARTCC) scopes when operating in the non-automation mode. (Video maps are shown but there are no alphanumerics.)

ARTS III Radar Scope with Alphanumeric Data. Note: A number of radar terminals do not have ARTS equipment. These facilities and certain ARTCC's outside the contiguous US would have radar displays similar to the lower right hand subset. ARTS facilities and NAS Stage A ARTCC's, when operating in the non-automation mode would also have similar displays and certain services based on automation may not be available.



Target Symbols

1 Uncorrelated primary radar target + ●
2 *Correlated primary radar target X
3 Uncorrelated beacon target /
4 Correlated beacon target \
5 Identing beacon target ≡
(*Correlated means the association of radar data with the computer projected track of an identified aircraft)

Position Symbols

6 Free track (No flight plan tracking) △
7 Flat track (flight plan tracking) ◊
8 Coast (Beacon target lost) #
9 Present Position Hold ⧗

Data Block Information

10 *Aircraft Identification
11 *Assigned Altitude FL280, mode C altitude same or within ±200′ of asgnd altitude
12 *Computer ID #191, Handoff is to Sector 33 (0-33 would mean handoff accepted) (*Nr's 10, 11, 12 constitute a "full data block")
13 Assigned altitude 17,000′, aircraft is climbing, mode C readout was 14,300 when last beacon interrogation was received
14 Leader line connecting target symbol and data block
15 Track velocity and direction vector line (Projected ahead of target)
16 Assigned altitude 7000, aircraft is descending, last mode C readout (or last reported altitude was 100′ above FL230
17 Transponder code shows in full data block only when different than assigned code
18 Aircraft is 300′ above assigned altitude
19 Reported altitude (No mode C readout) same as assigned. An "N" would indicate no reported altitude)
20 Transponder set on emergency code 7700 (EMRG flashes to attract attention)
21 Transponder code 1200 (VFR) with no mode C
22 Code 1200 (VFR) with mode C and last altitude readout
23 Transponder set on Radio Failure code 7600, (RDOF flashes)
24 Computer ID #228, CST indicates target is in Coast status
25 Assigned altitude FL290, transponder code (These two items constitute a "limited data block")

Other symbols

26 Navigational Aid
27 Airway or jet route
28 Outline of weather returns based on primary radar (See Chapter 4, ARTCC Radar Weather Display. H's represent areas of high density precipitation which might be thunderstorms. Radial lines indicate lower density precipitation)
29 Obstruction
30 Airports Major: □ , Small: ⌐

NAS Stage A Controllers View Plan Display. This figure illustrates the controller's radar scope (PVD) when operating in the full automation (RDP) mode, which is normally 20 hours per day. (Note: When not in automation mode, the display is similar to the broadband mode shown in the ARTS III Radar Scope figure. Certain ARTCC's outside the contiguous U.S. also operate in "broadband" mode.)

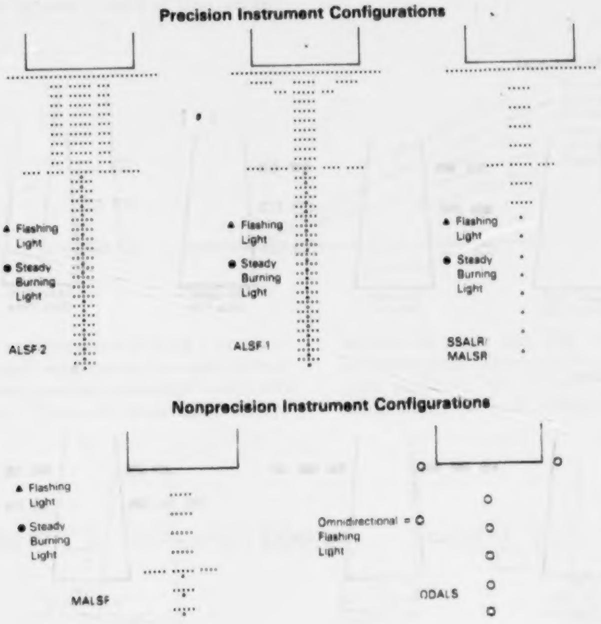
Chapter 2. AERONAUTICAL LIGHTING AND AIRPORT MARKING AIDS

Section 1. AIRPORT LIGHTING AIDS

. APPROACH LIGHT SYSTEMS (ALS)

a. Approach light systems provide the basic means for ansition from instrument flight using electronic approach ds to visual flight and landing. Operational requirements ctate the sophistication and configuration of the ap- roach light system for a particular runway.

b. Approach light systems are a configuration of signal lights starting at the landing threshold and extending into the approach area a distance of 2400-3000 feet for precision instrument runways and 1400-1500 feet for nonprecision instrument runways. Some systems include sequenced flashing lights which appear to the pilot as a ball of light traveling towards the runway at high speed twice a second.


Precision Instrument Configurations
▲ Flashing Light
● Steady Burning Light
ALSF 2
▲ Flashing Light
● Steady Burning Light
ALSF 1
▲ Flashing Light
● Steady Burning Light
SSALR/ MALSR
Nonprecision Instrument Configurations
▲ Flashing Light
● Steady Burning Light
MALSF
Omnidirectional = ○ Flashing Light
ODALS

41. VISUAL APPROACH SLOPE INDICATOR (VASI)

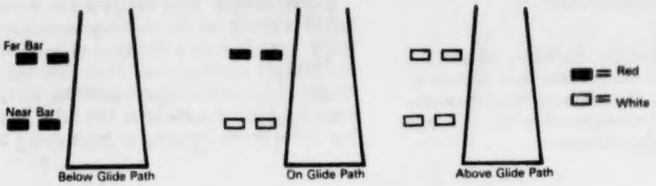
a. The VASI is a system of lights so arranged to provide visual descent guidance information during the approach to a runway. These lights are visible from 3-5 miles during the day and up to 20 miles or more at night. The visual glide path of the VASI provides safe obstruction clearance within plus or minus 10 degrees of the extended runway centerline and to 4 NM from the runway threshold. Descent, using the VASI, should not be initiated until the aircraft is visually aligned with the runway. Lateral course guidance is provided by the runway or runway lights.

b. VASI installations may consist of either 2, 4, 6, 12, or 16 lights units arranged in bars referred to as near, middle, and far bars. Most VASI installations consist of 2 bars, near and far, and may consist of 2, 4, or 12 light units. Some airports have VASIs consisting of three bars, near, middle, and far, which provide an additional visual glide path for use by high cockpit aircraft. This installation may consist of either 6 or 16 light units. VASI installations consisting of 2, 4, or 6 light units are located on one side of the runway, usually the left. Where the installation consists of 12 or 16 light units, the light units are located on both sides of the runway.

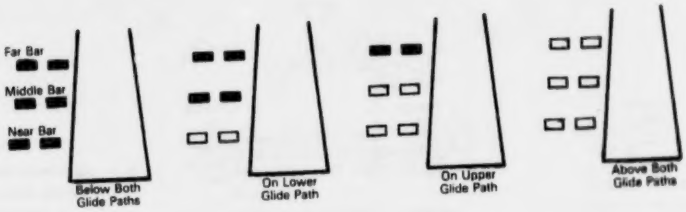
c. Two-bar VASI installations provide one visual glide path which is normally set at 3 degrees. Three-bar VASI installations provide two visual glide paths. The lower glide path is provided by the near and middle bars and is normally set at 3 degrees while the upper glide path, provided by the middle and far bars, is normally 1/4 degree higher. This higher glide path is intended for use only by high cockpit aircraft to provide a sufficient threshold crossing height. Although normal glide path angles are three degrees, angles at some locations may be as high as 4.5 degrees to give proper obstacle clearance. Pilots of high performance aircraft are cautioned that use of VASI angles in excess of 3.5 degrees may cause an increase in runway length required for landing and rollout.

d. The basic principle of the VASI is that of color differentiation between red and white. Each light unit projects a beam of light having a white segment in the upper part of the beam and red segment in the lower part of the beam. The light units are arranged so that the pilot using the VASIs during an approach will see the combination of lights shown below.

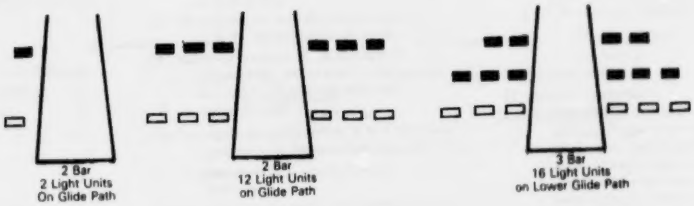
e. 2-bar VASI (4 light units shown)


Far Bar
Near Bar
Below Glide Path
On Glide Path
Above Glide Path
▬ = Red
▭ = White

f. 3-bar VASI (6 light units shown)


Far Bar
Middle Bar
Near Bar
Below Both Glide Paths
On Lower Glide Path
On Upper Glide Path
Above Both Glide Paths

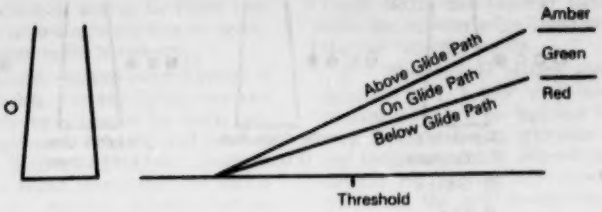
g. Other VASI configurations


2 Bar
2 Light Units
On Glide Path
2 Bar
12 Light Units
on Glide Path
3 Bar
16 Light Units
on Lower Glide Path

42. OTHER VISUAL APPROACH SLOPE SYSTEMS

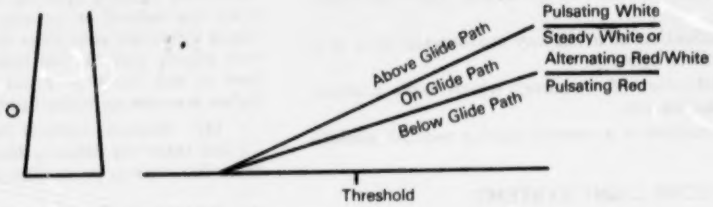
a. Several types of nonstandard visual approach slope indicators have been installed at general aviation and air carrier airports.

b. Tri-color visual approach slope indicators normally consist of a single light unit projecting a three-color visual approach path into the final approach area of the runway upon which the indicator is installed. The below glide path indication is red, the above glide path indication is amber, and the on glide path indication is green. These types of indicators have a useful range of approximately one-half to one mile during the day and up to five miles at night depending upon the visibility conditions.

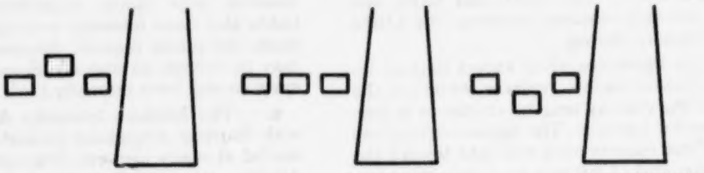

Amber
Green
Red
Above Glide Path
On Glide Path
Below Glide Path
Threshold

Caution: This yellow-green-red configuration produces a yellow-green transition light beam between the yellow and green primary light segments and an anomalous yellow transition light beam between the green and red primary light segments. This anomalous yellow signal could cause confusion with the primary yellow too-high signal.

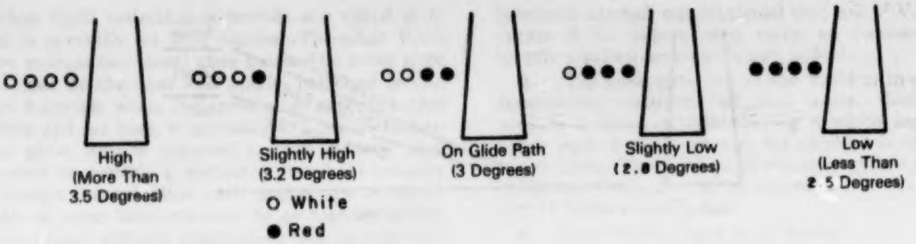
c. Pulsating visual approach slope indicators normally consist of a single light unit projecting a two-color visual approach path into the final approach area of the runway upon which the indicator is installed. The below glide path indication is normally pulsating red and the above glide path indication is normally pulsating white. The on glide path indication for one type of system is a steady white light while for another type system the on glide path indication consists of an alternating red and white light. The useful range of these systems is about four miles during the day and up to ten miles at night.


Pulsating White
Steady White or
Alternating Red/White
Pulsating Red
Above Glide Path
On Glide Path
Below Glide Path
Threshold

d. Alignment of elements systems are installed on some small general aviation airports and are a low-cost system consisting of painted plywood panels, normally black and white or fluorescent orange. Some of these systems are lighted for night use. The useful range of these systems is approximately three-quarter miles. To use the system the pilot positions his aircraft so the elements are in alignment. The glide path indications are as follows.


Above Glide Path
On Glide Path
Below Glide Path

e. The precision approach path indicator (PAPI) uses light units similar to the VASI but are installed in a single row of either two or four light units. These systems have an effective visual range of about 5 miles during the day and up to 20 miles at night. The row of light units is normally installed on the left side of the runway and the glide path indications are as follows.



43. RUNWAY END IDENTIFIER LIGHTS (REIL)

REILs are installed at many airfields to provide rapid and positive identification of the approach end of a particular runway. The system consists of a pair of synchronized flashing lights, one of which is located laterally on each side of the runway threshold. REILs may be either omnidirectional or unidirectional facing the approach area. REILs may be located longitudinally 200 feet either upwind or downwind from the runway threshold. They are effective for:

(1) Identification of a runway surrounded by a preponderance of other lighting.

(2) Identification of a runway which lacks contrast with surrounding terrain.

(3) Identification of a runway during reduced visibility.

44. RUNWAY EDGE LIGHT SYSTEMS

a. Runway edge lights are used to outline the edges of runways during periods of darkness and restricted visibility conditions. These light systems are classified according to the intensity or brightness they are capable of producing: they are the High Intensity Runway Lights (HIRL), Medium Intensity Runway Lights (MIRL), and the Low Intensity Runway Lights (LIRL). The HIRL and MIRL systems have variable intensity controls, whereas the LIRLs normally have one intensity setting.

b. The runway edge lights are white except that on instrument runways aviation yellow replaces white on the last 2,000 feet or half the runway length, whichever is less, to form a caution zone for landings. The lights marking the longitudinal limits of the runway emit red light toward the runway to indicate the end of runway to a departing aircraft and emit green outward from the runway end to indicate the threshold to landing aircraft.

45. IN-RUNWAY LIGHTING

a. Touchdown zone lighting and runway centerline lighting are installed on some precision approach runways to facilitate landing under adverse visibility conditions. Taxiway turnoff lights may be added to expedite movement of aircraft from the runway.

(1) **Touchdown Zone Lighting (TDZL) —** two rows of transverse light bars disposed symmetrically about the runway centerline in the runway touchdown zone. The system starts 100 feet from the landing threshold and extends to 3000 feet from the threshold or the midpoint of the runway, whichever is the lesser.

(2) **Runway Centerline Lighting (RCLS) —** flush centerline lights spaced at 50-foot intervals beginning 75 feet from the landing threshold and extending to within 75 feet of opposite end of the runway.

(3) **Runway Remaining Lighting —** is applied to centerline lighting systems in the final 3,000 feet as viewed from the takeoff or approach position. Alternate red and white lights are seen from the 3,000 foot points to the 1,000 foot points, and all red lights are seen for the last 1,000 feet of the runway. From the opposite direction, these lights are seen as white lights.

(4) **Taxiway turnoff lights —** flush lights spaced at 50 foot intervals defining the curved path of aircraft travel from the runway centerline to a point on the taxiway.

46. CONTROL OF LIGHTING SYSTEMS

a. Operation of approach light systems and runway lighting is controlled by the control tower. At some locations the FSS may control the lights where there is no control tower in operation.

b. Pilots may request that lights be turned on or off. Runway edge lights, in-pavement lights and approach lights also have intensity controls which may be varied to meet the pilots request. Sequenced flashing lights (SFL) may be turned on and off. Some sequenced flashing light systems also have intensity control.

c. The Medium Intensity Approach Lighting System with Runway Alignment Indicators (MALSR) has been installed at many airports. The control of MALSR is now by ATCTs and/or radio control from approaching aircraft. (See PARA—47 - PILOT CONTROL OF AIRPORT LIGHTING.)

47. PILOT CONTROL OF AIRPORT LIGHTING

a. Radio control of lighting is available at selected airports to provide airborne or ground control of lights by keying the aircraft's microphone. Control of lighting systems is available either full-time at those locations without specified hours for lighting or with no control tower or FSS, or part-time (during unmanned periods) at those locations with a part-time tower or FSS or specified hours for

lighting. All lighting systems which are to be radio controlled at an airport, whether on a single runway or multiple runways, operate on the same radio frequency.

b. With FAA approved systems, various combinations of medium intensity approach lights, runway lights, taxiway lights, VASI and/or REIL may be activated by radio control. On runways with both approach lighting and runway lighting (runway edge lights, taxiway lights, etc.) systems, the approach lighting system takes precedence for air-to-ground radio control over the runway lighting system which is set at a predetermined intensity step, based on expected visibility conditions. Runways without approach lighting may provide radio controlled intensity adjustments of runway edge lights. Other lighting systems, including VASI, REIL, and taxiway lights may be either controlled with the runway edge lights or controlled independently of the runway edge lights.

c. The control system consists of a 3-step control responsive to 7, 5, and/or 3 microphone clicks. This 3-step control will turn on lighting facilities capable of either 3-step, 2-step or 1-step operation. The 3-step and 2-step lighting facilities can be altered in intensity, while the 1-step cannot. All lighting is illuminated for a period of 15 minutes from the most recent time of activation and may not be extinguished prior to end of the 15 minute period (except for 1-step and 2-step REILs which may be turned off when desired by keying the mike 5 or 3 times respectively).

TABLE 1. RUNWAYS WITH APPROACH LIGHTS

Lighting System	No. of Int. Steps	Status During Nonuse Period	Intensity Step Selected Per No. of Mike Clicks		
			3 Clicks	5 Clicks	7 Clicks
Approach Lights (Med. Int.)	2	Off	Low	Low	High
Approach Lights (Med. Int.)	3	Off	Low	Med	High
MIRL	3	Off or Low	⌘	⌘	⌘
HIRL	5	Off or Low	⌘	⌘	⌘
VASI	2	Off	◊	◊	◊

NOTES:

⌘ Predetermined intensity step.
◊ Low intensity for night use. High intensity for day use as determined by photocell control.

TABLE 2. RUNWAYS WITHOUT APPROACH LIGHTS

Lighting System	No. of Int. Steps	Status During Nonuse Period	Intensity Step Selected Per No. of Mike Clicks		
			3 Clicks	5 Clicks	7 Clicks
MIRL	3	Off or Low	Low	Med.	High
HIRL	5	Off or Low	Step 1 or 2	Step 3	Step 5
LIRL	1	Off	On	On	On
VASI ☆	2	Off	◊	◊	◊
REIL ☆	1	Off	Off	On / Off	On
REIL ☆	3	Off	Low	Med.	High

NOTES:

◊ Low intensity for night use. High intensity for day use as determined by photocell control.
☆ The control of VASI and/or REIL may be independent of other lighting systems.

d. Suggested use is to always initially key the mike 7 times; this assures that all controlled lights are turned on to the maximum available intensity. If desired, adjustment can then be made, where the capability is provided, to a lower intensity (or the REIL turned off) by keying 5 and/or 3 times. Even though the runway lights are on when arriving over an airport of intended landing, always key mike as directed in order to assure a full 15 minutes lighting duration. Approved lighting systems may be activated by keying the mike (within 5 seconds) as indicated below:

RADIO CONTROL SYSTEM

Key Mike	*Function*
7 times within 5 seconds	Highest intensity available
5 times within 5 seconds	Medium or lower intensity (Lower REIL or REIL-off)
3 times within 5 seconds	Lowest intensity available (Lower REIL or REIL-off)

e. For all public use airports with FAA standard systems the Airport/Facility Directory contains the types of lighting, runway and the frequency that is used to activate the system. Airports with IAPs include data on the approach chart identifying the light system, the runway on which they are installed, and the frequency that is used to activate the system.

EXAMPLE:

ACTIVATE MIRL Rwy 18/36-122.8.

EXAMPLE:

ACTIVATE MALSR, VASI and REIL Rwy 7, HIRL Rwy 7-25, and REIL Rwy 25-122.8.

f. Where the airport is not served by an IAP, it may have either the standard FAA approved control system or an independent type system of different specification installed by the airport sponsor. The Airport/Facility Directory contains descriptions of pilot controlled lighting systems for each airport having other than FAA approved systems, and explains the type lights, method of control, and operating frequency in clear text.

48. AIRPORT (ROTATING) BEACONS

a. The airport beacon has a vertical light distribution such as to make it most effective at angles of one up to 10 degrees above the horizontal from its site; however, it can be seen well above and below this peak spread. The beacon may be an omnidirectional capacitor-discharge device, or it

may rotate at a constant speed which produces the visual effect of flashes at regular intervals. Flashes may be one or two colors alternately. The total number of flashes are:

(1) 12 to 30 per minute for beacons marking airports, landmarks, and points on Federal airways.

(2) 30 to 60 per minute for beacons marking heliports.

b. The colors and color combinations of beacons are:

(1) White and Green — Lighted land airport

(2) *Green alone — Lighted land airport

(3) White and Yellow — Lighted water airport

(4) *Yellow alone — Lighted water airport

(5) White and Red — Landmark or navigational point (rare installation)

(6) White alone — Unlighted land airport (rare installation)

(7) Green, Yellow, and White — Lighted heliport

NOTE.— *Green alone or yellow alone is used only in connection with a white-and-green or white-and-yellow beacon display, respectively.

c. Military airport beacons flash alternately white and green, but are differentiated from civil beacons by dual-peaked (two quick) white flashes between the green flashes.

d. In control zones, operation of the airport beacon during the hours of daylight often indicates that the ground visibility is less than 3 miles and/or the ceiling is less than 1,000 feet. ATC clearance in accordance with FAR—91 would be required for landing, takeoff and flight in the traffic pattern. Pilots should not rely solely on the operation of the airport beacon to indicate weather conditions, IFR versus VFR. At locations with control towers and if controls are provided, ATC personnel turn the beacon on. However, at many airports throughout the country, the airport beacon is turned on by a photoelectric cell or time clocks and ATC personnel have no control as to when it shall be turned on. Also, there is no regulatory requirement for daylight operation and pilots are reminded that it remains their responsibility for complying with proper preflight planning in accordance with FAR—91.5.

49. RUNWAY DISTANCE REMAINING MARKERS

Runway distance remaining markers consist of signs located along the sides of a runway to indicate the remaining runway distance in increments of 1,000 feet. The signs may be located on both sides, or only one side, of the runway. The signs have white numerals on a black background and are lighted for nighttime and low visibility operations. Since runways rarely exist in exact multiples of 1,000 feet, the excess distance is added to the runway ends. Therefore, the last sign on each runway end may be located more, but never less, then 1,000 feet from the runway end. For this reason, the runway distance remaining markers often will not exactly coincide with distance remaining information of other runway lighting systems.

NOTES

Section 2. AIR NAVIGATION AND OBSTRUCTION LIGHTING

50. AERONAUTICAL LIGHT BEACONS

a. An aeronautical light beacon is a visual NAVAID displaying flashes of white and/or colored light to indicate the location of an airport, a heliport, a landmark, a certain point of a Federal airway in mountainous terrain, or an obstruction. The light used may be a rotating beacon or one or more flashing lights. The flashing lights may be supplemented by steady burning lights of lesser intensity.

b. The color or color combination displayed by a particular beacon and/or its auxiliary lights tell whether the beacon is indicating a landing place, landmark, point of the Federal airways, or an obstruction. Coded flashes of the auxiliary lights, if employed, further identify the beacon site.

51. CODE BEACONS AND COURSE LIGHTS

a. CODE BEACONS

(1) The code beacon, which can be seen from all directions, is used to identify airports and landmarks and to mark obstructions. The number of code beacon flashes are:

(a) **Green coded flashes** not exceeding 40 flashes or character elements per minute, or constant flashes 12 to 15 per minute, for identifying land airports.

(b) **Yellow coded flashes** not exceeding 40 flashes or character elements per minute, or constant flashes 12 to 15 per minute, for identifying water airports.

(c) **Red flashes,** constant rate, 12 to 40 flashes per minute for marking hazards.

b. COURSE LIGHTS

(1) The course light, which can be seen clearly from only one direction, is used only with rotating beacons of the Federal Airway System: two course lights, back to back, direct coded flashing beams of light in either direction along the course of airway.

NOTE.— Airway beacons are remnants of the "lighted" airways which antedated the present electronically equipped Federal Airways System. Only a few of these beacons exist today to mark airway segments in remote mountain areas. Flashes in Morse Code identify the beacon site.

52. OBSTRUCTION LIGHTS

a. Obstructions are marked/lighted to warn airmen of its presence during daytime and nighttime conditions. They may be marked/lighted in any of the following combinations:

(1) **Aviation Red Obstruction Lights.** Flashing aviation red beacons and steady burning aviation red lights during nighttime operation. Aviation orange and white paint is used for daytime marking.

(2) **High Intensity White Obstruction Lights.** Flashing high intensity white lights during daytime with reduced intensity for twilight and nighttime operation. When this type system is used, the marking of structures with red obstruction lights and aviation orange and white paint may be omitted.

(3) **Dual Lighting.** A combination of flashing aviation red beacons and steady burning aviation red lights for nighttime operation and flashing high intensity white lights for daytime operation. Aviation orange and white paint may be omitted.

b. High intensity flashing white lights are being used to identify some supporting structures of overhead transmission lines located across rivers, chasms, gorges, etc. These lights flash in a middle, top, lower light sequence at approximately 60 flashes per minute. The top light is normally installed near the top of the supporting structure, while the lower light indicates the approximate lower portion of the wire span. The lights are beamed towards the companion structure and identify the area of the wire span.

c. High intensity, flashing white lights are also employed to identify tall structures, such as chimneys and towers, as obstructions to air navigation. The lights provide a 360 degree coverage about the structure at 40 flashes per minute and consist of from one to seven levels of lights depending upon the height of the structure. Where more than one level is used the vertical banks flash simultaneously.

53—59. RESERVED

NOTES

Section 3. AIRPORT MARKING AIDS

60. AIRPORT MARKING AIDS

a. In the interest of safety, regularity, or efficiency of aircraft operations, the FAA has recommended, for the guidance of the public, the following airport marking.

NOTE.— Refer to ADVISORY CIRCULAR—150/5340-1 Marking of Paved Areas on Airports for detailed airport marking information.

b. Runway designators — Runway numbers and letters are determined from the approach direction. The runway number is the whole number nearest one-tenth the magnetic azimuth of the centerline of the runway, measured clockwise from the magnetic north. The letter, or letters, differentiate between left (L), right (R), or center (C) parallel runways, as applicable:

(1) For two parallel runways "L" "R"

(2) For three parallel runways "L" "C" "R"

c. Visual Runway Marking — Used for operations under Visual Flight Rules:

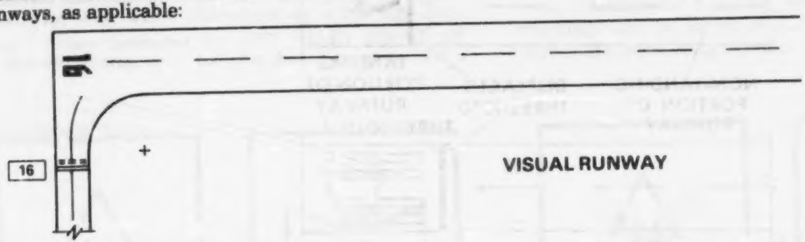
(1) Centerline marking.

(2) Designation marking.

(3) Threshold marking (on runways used or intended to be used by international commercial air transport.)

(4) Fixed distance marking (on runways 4,000 feet (1200 m) or longer used by jet aircraft.)

(5) Holding position markings (for taxiway/runway intersections.)



VISUAL RUNWAY

d. NonPrecision Instrument Runway Marking — Used on runways served by a nonvisual navigation aid and intended for landings under instrument weather conditions:

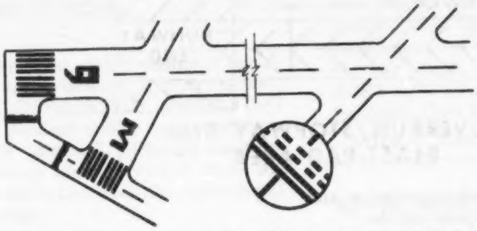
(1) Centerline marking.

(2) Designation marking.

(3) Threshold marking.

(4) Fixed distance marking (on runways 4,000 feet (1200 m) or longer used by jet aircraft.

(5) Holding position markings (for taxiway/runway intersections and instrument landing system (ILS) critical areas.)



NON-PRECISION INSTRUMENT RUNWAY

e. Precision Instrument Runway Marking — Used on runways served by nonvisual precision approach aids and on runways having special operational requirements:

(1) Centerline marking.

(2) Designation marking.

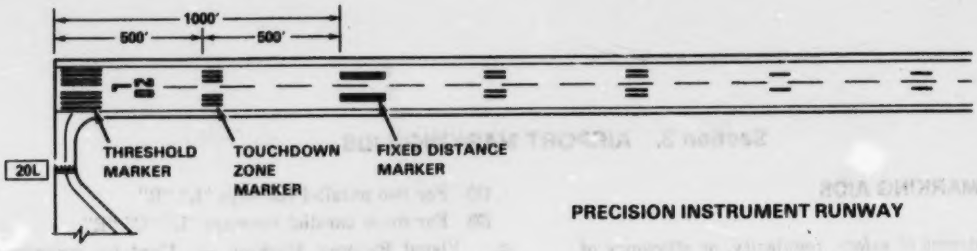
(3) Threshold marking.

(4) Fixed distance marking.

(5) Touchdown zone marking.

(6) Side stripes.

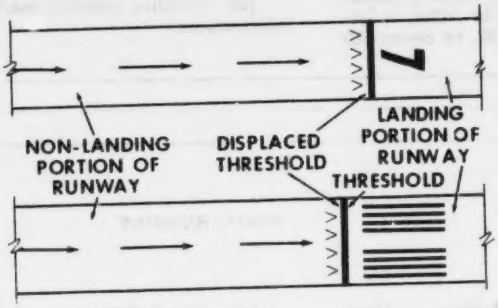
(7) Holding position markings (for taxiway/runway intersections and ILS critical areas.)


1000′
500′
500′
20L
THRESHOLD MARKER
TOUCHDOWN ZONE MARKER
FIXED DISTANCE MARKER

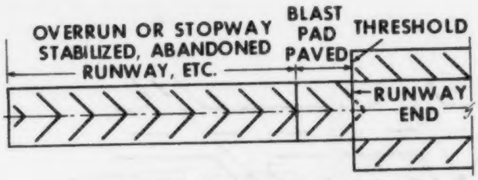
PRECISION INSTRUMENT RUNWAY

f. Threshold — The designated beginning of the runway that is available and suitable for the landing of aircraft.

g. Displaced Threshold — A threshold that is not at the beginning of the full strength runway pavement. The paved area behind the displaced runway threshold is ava able for taxiing, the landing rollout, and the takeoff of a craft.

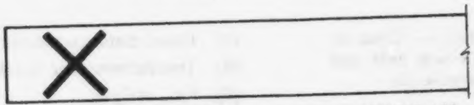

NON-LANDING PORTION OF RUNWAY
DISPLACED THRESHOLD
LANDING PORTION OF RUNWAY
THRESHOLD

h. Overrun and Stopway Areas — Any surface or area extending beyond the usable runway which appears usable but which, due to the nature of its structure, is unusable.


OVERRUN OR STOPWAY STABILIZED, ABANDONED RUNWAY, ETC.
BLAST PAD PAVED
THRESHOLD
RUNWAY END

1. OVERRUN/STOPWAY AND BLAST PAD AREA

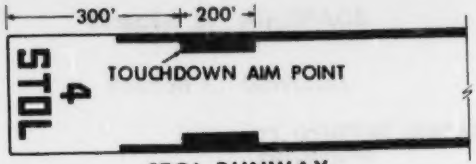
i. Closed Runway — A runway which is unusable and may be hazardous even though it may appear usable.



2. CLOSED RUNWAY OR TAXIWAY

j. **Fixed Distance Marker** — To provide a fixed distance marker for landing of turbojet aircraft on other than a precision instrument runway. This marking is similar to the fixed distance marking on a precision instrument runway and located 1,000 feet from the threshold.

k. **STOL (Short Take Off and Landing) Runway** — In addition to the normal runway number marking, the letters STOL are painted on the approach end of the runway and a touchdown aim point is shown.

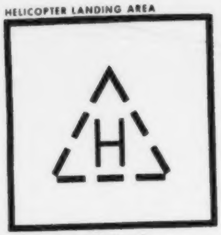


STOL RUNWAY

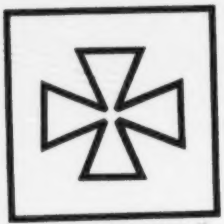
l. **Taxiway Marking** — The taxiway centerline is marked with a continuous yellow line. The taxiway edge may be marked with two continuous yellow lines 6 inches apart. Taxiway HOLDING LINES consist of two continuous and two dashed lines, spaced 6 inches between lines, perpendicular to the taxiway centerline; more recently, HOLD LINES also consist of one or more signs at the edge of the taxiway, with white characters on a red sign face.

NOTE.— When instructed by ATC "HOLD SHORT OF (runway, ILS critical area, etc.)," the pilot should stop so no part of the aircraft extends beyond the holding line. When approaching the holding line from the side with the continuous lines, a pilot should not cross the holding line without ATC clearance at a controlled airport or without making sure of adequate separation from other aircraft at uncontrolled airports. An aircraft exiting the runway is not clear until all parts of the aircraft have crossed the holding line.

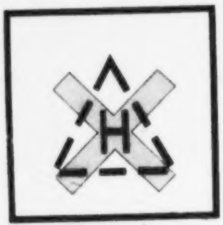
m. **Helicopter Landing Areas** — Details on heliport markings can be found in ADVISORY CIRCULAR—150/5390-1, Heliport Design Guide.



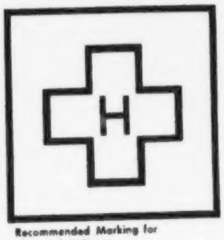
Recommended Marking for Civil Heliports



Some Civil and Military Heliports May Be Marked With This Symbol



Recommended Marking for Closed Heliports



Recommended Marking for Hospital Heliports

61. AIRCRAFT ARRESTING DEVICES

a. Certain airports are equipped with a means of rapidly stopping military aircraft on a runway. This equipment, normally referred to as EMERGENCY ARRESTING GEAR, generally consists of pendant cables supported over the runway surface by rubber "donuts". Although most devices are located in the overrun areas, a few of these arresting systems have cables stretched over the operational areas near the ends of a runway.

b. Arresting cables which cross over a runway require special markings on the runway to identify the cable location. These markings consist of 10 feet diameter solid circles painted "identification yellow", 30 feet on center, perpendicular to the runway centerline across the entire runway width. Additional details are contained in ADVISORY CIRCULAR—150/5220-9, Aircraft Arresting Systems for Joint/Civil Military Airports.

NOTE.— Aircraft operations on the runway are NOT restricted by the installation of aircraft arresting devices.

62—69. RESERVED

NOTES

Chapter 3. AIRSPACE

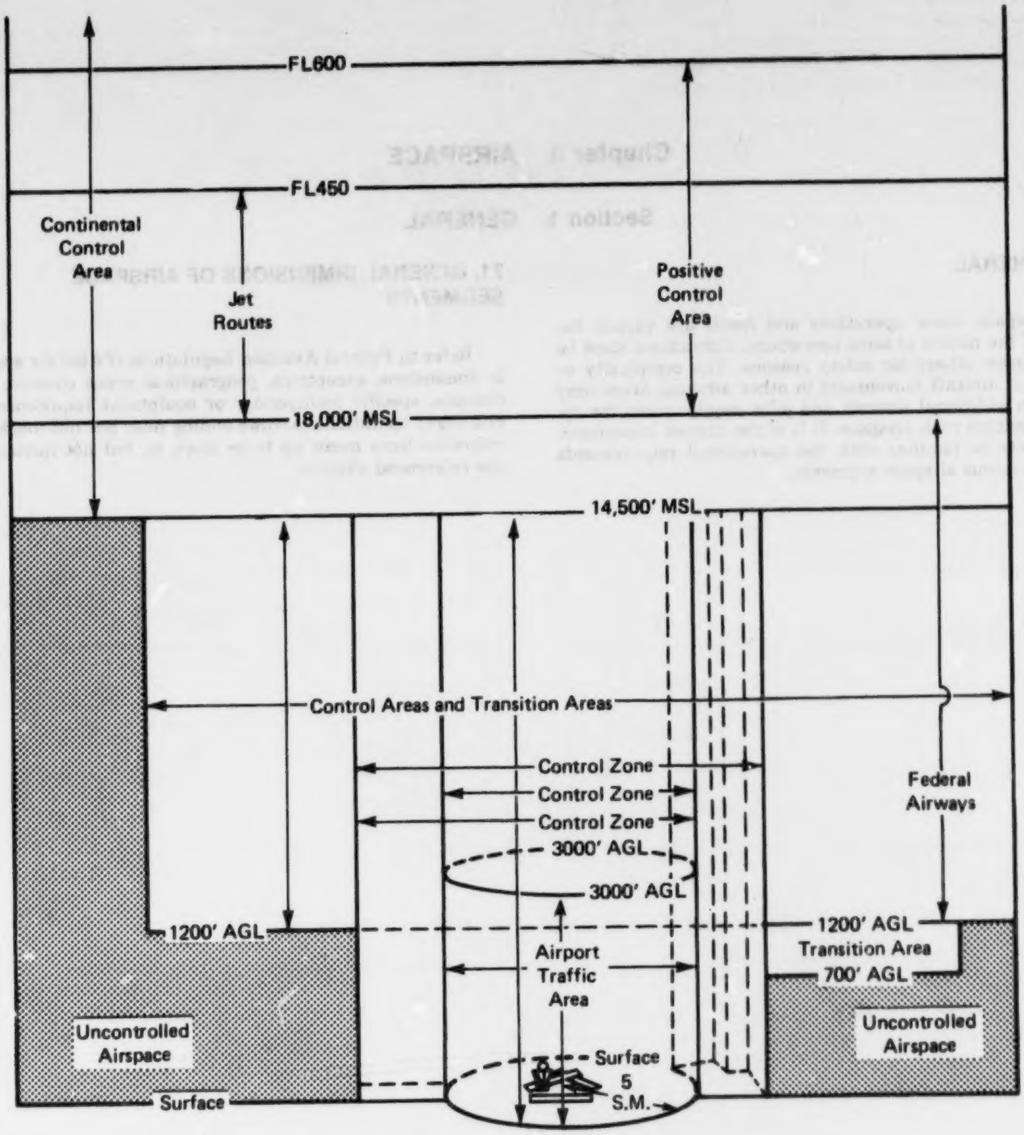
Section 1. GENERAL

70. GENERAL

Airspace users' operations and needs are varied. Because of the nature of some operations, restrictions must be placed upon others for safety reasons. The complexity or density of aircraft movements in other airspace areas may result in additional aircraft and pilot requirements for operation within such airspace. It is of the utmost importance that pilots be familiar with the operational requirements for the various airspace segments.

71. GENERAL DIMENSIONS OF AIRSPACE SEGMENTS

Refer to Federal Aviation Regulations (FARs) for specific dimensions, exceptions, geographical areas covered, exclusions, specific transponder or equipment requirements, and flight operations. Arrows ending near but not touching reference lines mean up to or down to, but not including, the referenced altitude.


FL600
FL450
Continental Control Area
Jet Routes
Positive Control Area
18,000' MSL
14,500' MSL
Control Areas and Transition Areas
Control Zone
Control Zone
Control Zone
Federal Airways
3000' AGL
3000' AGL
1200' AGL
1200' AGL
Transition Area
700' AGL
Airport Traffic Area
Uncontrolled Airspace
Uncontrolled Airspace
Surface
Surface
5 S.M.

72—79. RESERVED

Section 2. UNCONTROLLED AIRSPACE

80. GENERAL

Uncontrolled airspace is that portion of the airspace that has not been designated as Continental Control Area, Control Area, Control Zone, Terminal Control Area, or Transition Area.

81. VFR REQUIREMENTS

Rules governing VFR flight have been adopted to assist the pilot in meeting his responsibility to see and avoid other aircraft. Minimum weather conditions and distance from clouds required for VFR flight are contained in these rules. (FAR—91.105.)

82. IFR REQUIREMENTS

FARs specify the pilot and aircraft equipment requirements for IFR flight. Pilots are reminded that in addition to altitude or flight level requirements, FAR—91.119 includes a requirement to remain at least 1,000 feet (2,000 feet in designated mountainous terrain) above the highest obstacle within a horizontal distance of 5 statute miles from the course to be flown.

83. MINIMUM VFR VISIBILITY AND DISTANCE FROM CLOUDS

ALTITUDE	UNCONTROLLED AIRSPACE		CONTROLLED AIRSPACE	
	Flight Visibility	Distance From Clouds	**Flight Visibility	**Distance From Clouds
1200′ or less above the surface, regardless of MSL Altitude.	*1 statute mile	Clear of clouds	3 statute miles	500′ below 1000′ above 2000′ horizontal
More than 1200′ above the surface, but less than 10,000′ MSL.	1 statute mile	500′ below 1000′ above 2000′ horizontal	3 statute miles	500′ below 1000′ above 2000′ horizontal
More than 1200′ above the surface and at or above 10,000′ MSL.	5 statute miles	1000′ below 1000′ above 1 statute mile horizontal	5 statute miles	1000′ below 1000′ above 1 statute mile horizontal

*Helicopters may operate with less than 1 mile visibility, outside controlled airspace at 1200 feet or less above the surface, provided they are operated at a speed that allows the pilot adequate opportunity to see any air traffic or obstructions in time to avoid collisions.

**In addition, when operating within a control zone beneath a ceiling, the ceiling must not be less than 1000′. If the pilot intends to land or takeoff or enter a traffic pattern within a control zone, the ground visibility must be at least 3 miles at that airport. If ground visibility is not reported at the airport, 3 miles flight visibility is required. (FAR 91.105)

84. ALTITUDES AND FLIGHT LEVELS

CONTROLLED AND UNCONTROLLED AIRSPACE VFR ALTITUDES AND FLIGHT LEVELS

If your magnetic course (ground track) is	More than 3000′ above the surface but below 18,000′ MSL fly	Above 18,000′ MSL to FL 290 (except within Positive Control Area, FAR 71.193) fly	Above FL 290 (except within Positive Control Area, FAR 71.193) fly 4000′ intervals
0° to 179°	Odd thousands, MSL, plus 500′ (3500, 5500, 7500, etc.).	Odd Flight Levels plus 500′ (FL 195, FL 215, FL 235, etc.).	Beginning at FL 300 (FL 300, 340, 380, etc.)
180° to 359°	Even thousands, MSL, plus 500′ (4500, 6500, 8500, etc.).	Even Flight Levels plus 500′ (FL 185, FL 205, FL 225, etc.).	Beginning at FL 320 (FL 320, 360, 400, etc.)

UNCONTROLLED AIRSPACE - IFR ALTITUDES AND FLIGHT LEVELS

If your magnetic course (ground track) is	Below 18,000′ MSL fly	At or above 18,000′ MSL but below FL 290, fly	At or above FL 290, fly 400 intervals
0° to 179°	Odd thousands, MSL, (3000, 5000, 7000, etc.).	Odd Flight Levels, FL 190, 210, 230, etc.).	Beginning at FL 290, (FL 290, 3 370, etc.)
180° to 359°	Even thousands, MSL, (2000, 4000, 6000, etc.).	Even Flight Levels (FL 180, 200, 220, etc.).	Beginning at FL 310, (FL 310, 3 390, etc.)

85—89. RESERVED

Section 3. CONTROLLED AIRSPACE

90. GENERAL

Controlled airspace consists of those areas designated as Continental Control Area, Control Area, Control Zones, Terminal Control Areas and Transition Areas, within which some or all aircraft may be subject to ATC. Safety, users' needs, and volume of flight operations are some of the factors considered in the designation of controlled airspace. When so designated, the airspace is supported by ground to air communications, navigation aids, and air traffic services.

91. CONTINENTAL CONTROL AREA

a. The Continental Control Area consists of the airspace of the 48 contiguous States, the District of Columbia and Alaska, excluding the Alaska peninsula west of longitude 160 degrees 00 minutes 00 seconds W, at and above 14,500 feet MSL, but does not include:

(1) The airspace less than 1,500 feet above the surface of the earth; or

(2) Prohibited and Restricted areas, other than the Restricted areas listed in FAR—71 Subpart D.

92. CONTROL AREAS

Control Areas consist of the airspace designated as Colored Federal airways, VOR Federal airways, Additional Control Areas, and Control Area Extensions, but do not include the Continental Control Area. Unless otherwise designated, Control Areas also include the airspace between a segment of a main VOR airway and its associated alternate segments. The vertical extent of the various categories of airspace contained in Control Areas is defined in FAR—71.

93. POSITIVE CONTROL AREA

Positive Control Area is airspace so designated as positive control area in FAR—71.193. This area includes specified airspace within the conterminous U.S. from 18,000 feet to and including FL 600, excluding Santa Barbara Island, Farallon Island, and that portion south of latitude 25 degrees 04 minutes north. In Alaska, it includes the airspace over the State of Alaska from 18,000 feet to and including FL 600, but not including the airspace less than 1,500 feet above the surface of the earth and the Alaskan Peninsula west of longitude 160 degrees 00 minutes west. Rules for operating in Positive Control Area are found in FAR—91.97 and FAR—91.24.

94. TRANSITION AREAS

a. Transition Areas are designated to contain IFR operations in controlled airspace during portions of the terminal operation and while transitioning between the terminal and en route environments.

b. Transition Areas are controlled airspace extending upward from 700 feet or more above the surface when designated in conjunction with an airport for which an instrument approach procedure has been prescribed; or from 1,200 feet or more above the surface when designated in conjunction with airway route structures or segments. Unless specified otherwise, Transition Areas terminate at the base of overlying controlled airspace.

95. CONTROL ZONES

a. Control Zones are regulatory in nature and established as controlled airspace. They extend upward from the surface and terminate at the base of the Continental Control Area. Control Zones that do not underlie the Continental Control Area have no upper limit. A Control Zone is based on a primary airport but may include one or more airports and is normally a circular area within a radius of 5 statute miles around the primary airport, except that it may include extensions necessary to include instrument departure and arrival paths.

b. Some basic requirements for designating a control zone are communications and weather observation reporting:

(1) Communications capability with aircraft which normally operate within the control zone must exist down to the runway surface of the primary airport. Communications may be either direct from the ATC facility having jurisdiction over the control zone or by rapid relay through other communications facilities which are acceptable to that ATC facility.

(2) Federally certificated weather observers take hourly and special weather observations at the primary airport in the control zone during the times and dates a control zone is designated. The required weather observations must be forwarded expeditiously to the ATC facility having jurisdiction over the control zones.

c. Control Zones are depicted on charts (for example, on the Sectional Charts the Control Zone is outlined by a broken blue line). If a Control Zone is effective only during certain hours of the day (a part-time Control Zone as prescribed in the regulation) it will be reflected on the charts. A typical Control Zone is depicted in PARA—71. (See PARA—264 - SPECIAL VFR CLEARANCES.)

96. TERMINAL CONTROL AREA

a. A Terminal Control Area (TCA) consists of controlled airspace extending upward from the surface or higher to specified altitudes, within which **all aircraft** are subject to the operating rules and pilot and equipment requirements specified in FAR—91. TCAs are described in FAR—71. Each TCA location is designated as either a Group I or Group II TCA, and includes at least one primary airport around which the TCA is located. (See FAR—71.12.)

(1) Group I TCAs represent some of the busiest locations in terms of aircraft operations and passengers car-

ried. For reasons of safety it is necessary to have strict requirements for operation within Group I TCAs. (See FAR—91.70(c) and FAR—91.90.)

(2) Group II TCAs represent less busy locations, and though safety dictates some pilot and equipment requirements, requirements are not as stringent as those for Group I locations. (See FAR—91.70(c) and FAR—91.90.)

b. TCAs are charted on Sectional, World Aeronautical
En route Low Altitude, DOD FLIP and TCA Charts.

(1) The following areas are currently designated a
Group I TCAs and are depicted on VFR Terminal Are
Charts.

Atlanta
Boston
Chicago
Dallas
Los Angeles
Miami
New York
San Francisco
Washington, D.C.

(2) The following areas are currently designated as Group II TCAs and are depicted on VFR Terminal Area Charts.

Cleveland
Denver
Detroit
Honolulu
Houston
Kansas City
Las Vegas
Minneapolis
New Orleans
Philadelphia
Pittsburgh
Seattle
St. Louis
San Diego

97. TERMINAL CONTROL AREA (TCA) OPERATION

a. Operating Rules and Equipment Requirements. Regardless of weather conditions, ATC authorization is required prior to operating within a TCA. Pilots should not request such authorization unless the requirements of FAR—91.24 and FAR—91.90 are met. Included among these requirements are:

(1) Group I TCAs

(a) A two-way radio capable of communicating with ATC on appropriate frequencies.

(b) A VOR or TACAN receiver, except for helicopters.

(c) A 4096 code transponder with MODE C automatic altitude reporting equipment, except for helicopters operating at or below 1,000 feet AGL under a Letter of Agreement.

NOTE.— ATC may, upon notification, immediately authorize a deviation from the altitude reporting equipment requirement; however, request for a deviation from the 4096 transponder equipment requirement must be submitted to the controlling ATC facility at least 1 hour before the proposed operation.

(d) A private pilot certificate or better in order to land or takeoff from an airport within the TCA.

(e) Unless otherwise authorized by ATC, each person operating a large turbine engine powered airplane to or from a primary airport shall operate at or above the designated floors while within the lateral limits of the TCA.

(f) No person may operate an aircraft in the airspace underlying a TCA, at an indicated airspeed of more than 200 knots (230 mph) (FAR—91.70).

(2) Group II TCAs.

(a) A two-way radio capable of communicating wit
ATC on appropriate frequencies.

(b) A VOR or TACAN receiver, except for helico
ters.

(c) A 4096 code transponder, except for helicopte
operating at or below 1,000 feet under a Letter of Agre
ment, or for IFR flights operating to or from an airpo
outside of but in close proximity to the TCA when the co
monly used transition, approach, or departure procedur
to such airport require flight within the TCA.

NOTE.— ATC may authorize deviations from the transpond
requirements. Requests for deviation must be submitted to t
controlling ATC facility at least 1 hour before the proposed op
ation.

(d) Unless otherwise authorized by ATC, large tu
bine powered aircraft must operate at or above the floor
the TCA while operating to or from the primary airport.

(e) No person may operate an aircraft in the a
space underlying a TCA, at an indicated airspeed of mo
than 200 knots (230 mph) (FAR—91.70).

b. Flight Procedures.

(1) *IFR Flights.* Aircraft within the TCA are
quired to operate in accordance with current IFR pro
dures. A clearance for a visual approach to a primary a
port is not authorization for turbine powered airplanes
operate below the designated floors of the TCA.

(2) *VFR Flights.*

(a) Arriving flights must contact ATC on the app
priate frequency and in relation to geographical fi
shown on local charts. Although a pilot may be operat

beneath the floor of the TCA on initial contact, communications with ATC should be established in relation to the points indicated for spacing and sequencing purposes.

(b) Departing aircraft require a clearance to depart the TCA and should advise the clearance delivery position of their intended altitude and route of flight. ATC will normally advise VFR aircraft when leaving the geographical limits of the TCA. Radar service is not automatically terminated with this advisory unless specifically stated by the controller.

(c) Aircraft not landing or departing the primary airport may obtain ATC clearance to transit the TCA when traffic conditions permit and provided the requirements of FAR—91.90 are met. Such VFR aircraft are encouraged, to the extent possible, to operate at altitudes above or below the TCA or transit through established VFR corridors. Pilots operating in VFR corridors are urged to use frequency 122.750 MHZ for the exchange of aircraft position information.

(d) VFR non-TCA aircraft are cautioned against operating too closely to TCA boundaries, especially where the floor of the TCA is 3,000 feet or less or where normal VFR cruise altitudes are at or near the floor of higher levels. Observance of this precaution will reduce the potential for encountering a TCA aircraft operating at TCA floor altitudes.

c. ATC Clearances and Separation. While operating within a TCA, pilots are provided the service and separation as in Stage III. (See PARA—165 - TERMINAL RADAR PROGRAM FOR VFR AIRCRAFT.) In the event of a radar outage, separation and sequencing of VFR aircraft will be suspended as this service is dependent on radar. The pilot will be advised that the service is not available and issued wind, runway information and the time or place to contact the tower. Traffic information will be provided on a workload permitting basis.

(1) Assignment of radar headings and/or altitudes to aircraft operating in accordance with visual flight rules are based on the provision that a pilot must request an amended clearance if compliance with an assigned route, radar heading or altitude will cause the pilot to violate Basic VFR Weather Minimums.

(2) ATC may assign altitudes to VFR aircraft that do not conform to FAR—91.109. When the altitude assignment is no longer needed for separation or when leaving the TCA, the instruction will be broadcast. "Resume Appropriate VFR Altitudes." Pilots must return to an altitude that conforms to FAR—91.109 as soon as practicable.

98. IFR ALTITUDES AND FLIGHT LEVELS

Pilots operating IFR within controlled airspace will fly at an altitude or flight level assigned by ATC. When operating IFR within controlled airspace with an altitude assignment of **VFR ON TOP**, flight is to be conducted at an appropriate VFR altitude which is not below the minimum IFR altitude for the route. (See PARA—84.) **VFR ON TOP** is not permitted in certain airspace areas, such as positive control airspace, certain Restricted Areas, etc. Consequently, IFR flights operating **VFR ON TOP** will avoid such airspace.

99. RESERVED

100. AIRPORT RADAR SERVICE AREA (ARSA)

a. An Airport Radar Service Area (ARSA) consists of controlled airspace extending upward from the surface or higher to specified altitudes, within which all aircraft are subject to the operating rules and pilot and equipment requirments specified in FAR—91. ARSAs are described in FAR—71. (See FAR—71.14.)

b. Dimensions

(1) *ARSA* (A basic standard design with minor site specific variations.) The ARSA airspace consists of two circles, both centered on the primary/ARSA airport. The inner circle has a radius of 5NM. The outer circle has a radius of 10NM. The airspace of the inner circle extends from the surface of the ARSA airport up to 4,000 feet above that airport. The airspace area between the 5 and 10NM rings begins at a height 1,200 feet AGL and extends to the same altitude cap as the inner circle.

(2) *OUTER AREA* The normal radius will be 20NM, with some variations based on site specific requirements. The outer area extends outward from the primary/ARSA airport and extends from the lower limits of radar/radio coverage up to the ceiling of the approach control's delegated airspace, excluding the ARSA and other airspace as appropriate.

c. ARSAs are charted on Sectional Charts, and some Terminal Control Area Charts.

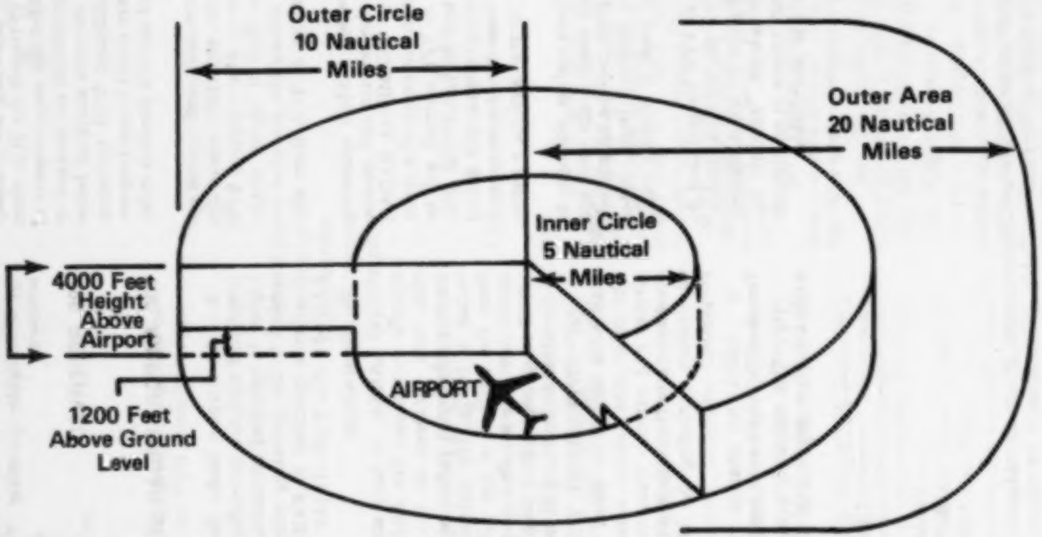
(1) The following areas are currently designated as ARSAs and are depicted on Sectional Charts.

STATE	CITY
MARYLAND	Baltimore
OHIO	Columbus
TEXAS	Austin

This list will be updated as additional ARSAs are implemented. Pilots should consult current sectional charts and NOTAMs for the latest information on services available. Pilots should be aware that some ARSAs underlie or are adjacent to TCAs.

496-568 O - 85 - 3

Airport Radar Service Area (ARSA)


Outer Circle
10 Nautical
Miles
Outer Area
20 Nautical
Miles
Inner Circle
5 Nautical
Miles
4000 Feet
Height
Above
Airport
1200 Feet
Above Ground
Level
AIRPORT

Services upon establishing two-way radio communication and radar contact:

Sequencing Arrivals

IFR/IFR Standard Separation

IFR/VFR Traffic Advisories and Conflict Resolution

VFR/VFR Traffic Advisories

Note: The normal radius of the Outer Area, will be 20nm, with some site specific variations.

IFR: Instrument Flight Rules
VFR: Visual Flight Rules

101. AIRPORT RADAR SERVICE AREA (ARSA) OPERATION

a. Operating Rules and Pilot/Equipment Requirements

(1) Pilot Certification: Student Pilot or better.

(2) Equipment: Two-Way Radio.

(3) Arrivals and Overflights: No person may operate an aircraft in an airport radar service area unless two-way radio communication is established with ATC prior to entering that ARSA and is thereafter maintained with ATC, while within that area.

(4) Departures:

(a) Primary Airport: No person may operate an aircraft within the ARSA unless two-way radio communication is maintained with ATC while within that ARSA.

(b) Satellite Airports: Aircraft departing satellite airports/heliports within the ARSA surface area shall establish two-way communication with ATC as soon as possible. Pilots must comply with approved FAA traffic patterns when departing these airports.

(5) ULTRALIGHT VEHICLES: No person may operate an ultralight vehicle within an airport radar service area unless that person has prior authorization from the air traffic control facility having jurisdiction over that airspace. (FAR—103)

(6) Parachute Jumps: No person may make a parachute jump and no pilot in command may allow a parachute jump to be made from that aircraft in or into an airport radar service area without, or in violation of, the terms of an ATC authorization. (FAR—105)

(7) Hot Air Balloons: No person may operate a hot air balloon within an airport radar service area unless that person has prior authorization from the air traffic control facility having jurisdiction over that airspace. (FAR—91)

b. ATC Services

(1) Within The ARSA:

(a) Sequencing of all aircraft arriving the primary/ARSA airport.

(b) Standard IFR separation between IFR aircraft.

(c) Between IFR and VFR aircraft - traffic advisories and conflict resolution so that radar targets do not touch, or 500 feet vertical separation.

(d) Between VFR aircraft - traffic advisories and as appropriate, safety alerts.

(2) Within The Outer Area:

(a) The same services are provided for aircraft operating within the outer area, as within the ARSA, *when two-way communication and radar contact is established.*

(b) While pilot participation in this area is strongly encouraged, it is not a VFR requirement.

(3) Beyond The Outer Area:

(a) Standard IFR separation.

(b) Basic Radar Service.

(c) Stage II/Stage III Service, where appropriate.

(d) Safety Alert, as appropriate.

c. Since this is a radar program ARSA services will only be provided within radar/radio coverage. In the event of a radar outage, separation and sequencing of VFR aircraft will be suspended. The pilot will be advised that the service is not available and issued wind, runway information and the time to contact the tower.

d. While pilot participation is required within the ARSA, it is voluntary within the outer area and can be discontinued, within the outer area, at the pilots request.

e. Traffic advisories and conflict resolution will be provided in the outer area unless the pilot requests to discontinue the service.

f. Service provided beyond the outer area will be on a workload permitting basis and can be terminated by the controller if the IFR/ARSA workload increases to a point that approaches controller/position capacity.

g. ARSA service will not be provided to an aircraft operating in a satellite airport's airport traffic area (ATA) and in communication with that satellite airport's air traffic control tower even though that airport underlies the ARSA. When an aircraft is instructed to contact the tower of a satellite airport, ARSA service automatically stops and *Airport* Traffic Control Service begins.

h. Two-way communication with a satellite control tower does not authorize an aircraft to enter the ARSA. A pilot who wishes to exit a satellite ATA into an ARSA must establish two-way communication with the ARSA facility, prior to entering the ARSA.

i. Aircraft proceeding to a satellite airport or to a VFR practice area within the outer area can expect to have radar service terminated at a sufficient distance to allow time to change to the appropriate frequency for traffic/airport information.

j. Some approach control facilities shut down for portions of the night. When this occurs at an ARSA facility, ARSA service will not be provided during those periods even though radar service is provided to that airport by an air route traffic control center.

102—109. RESERVED

NOTES

Section 4. SPECIAL USE AIRSPACE

110. GENERAL

Special use airspace consists of that airspace wherein activities must be confined because of their nature, or wherein limitations are imposed upon aircraft operations that are not a part of those activities, or both. Except for Controlled Firing Areas, special use airspace areas are depicted on aeronautical charts.

111. PROHIBITED AREA

Prohibited Areas contain airspace of defined dimensions identified by an area on the surface of the earth within which the flight of aircraft is prohibited. Such areas are established for security or other reasons associated with the national welfare. These areas are published in the Federal Register and are depicted on aeronautical charts.

112. RESTRICTED AREA

Restricted Areas contain airspace identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Activities within these areas must be confined because of their nature or limitations imposed upon aircraft operations that are not a part of those activities or both. Restricted areas denote the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. Penetration of Restricted Areas without authorization from the using or controlling agency may be extremely hazardous to the aircraft and its occupants. Restricted Areas are published in the Federal Register and constitute FAR—73. (See PARA—346 - OPERATION IN RESTRICTED AIRSPACE.)

113. WARNING AREA

Warning Areas are airspace which may contain hazards to nonparticipating aircraft in international airspace. Warning Areas are established beyond the 3 mile limit. Though the activities conducted within Warning Areas may be as hazardous as those in Restricted Areas, Warning Areas cannot be legally designated as Restricted Areas because they are over international waters. Penetration of Warning Areas during periods of activity may be hazardous to the aircraft and its occupants. Official descriptions of Warning Areas may be obtained on request to the FAA, Washington, D.C.

114. MILITARY OPERATIONS AREAS (MOA)

a. MOAs consist of airspace of defined vertical and lateral limits established for the purpose of separating certain military training activities from IFR traffic. Whenever a MOA is being used, nonparticipating IFR traffic may be cleared through a MOA if IFR separation can be provided by ATC. Otherwise, ATC will reroute or restrict nonparticipating IFR traffic.

b. Most training activities necessitate acrobatic or abrupt flight maneuvers. Military pilots conducting flight in Department of Defense aircraft within a designated and active military operations area (MOA) are exempted from the provisions of FAR 91.71(c) and (d) which prohibit acrobatic flight within Federal airways and control zones.

c. Pilots operating under VFR should exercise extreme caution while flying within a MOA when military activity is being conducted. The activity status (active/inactive) of MOA's may change frequently. Therefore, pilots should contact any FSS within 100 miles of the area to obtain accurate real-time information concerning the MOA hours of operation. Prior to entering an active MOA, pilots should contact the controlling agency for traffic advisories.

d. MOA's are depicted on Sectional, VFR Terminal, Area and Low Altitude En Route Charts.

115. ALERT AREA

Alert Areas are depicted on aeronautical charts to inform nonparticipating pilots of areas that may contain a high volume of pilot training or an unusual type of aerial activity. Pilots should be particularly alert when flying in these areas. All activity within an Alert Area shall be conducted in accordance with FARs, without waiver, and pilots of participating aircraft as well as pilots transiting the area shall be equally responsible for collision avoidance. Information concerning these areas may be obtained upon request to the FAA, Washington, D.C.

116. CONTROLLED FIRING AREAS

Controlled Firing Areas contain activities which, if not conducted in a controlled environment, could be hazardous to nonparticipating aircraft. The distinguishing feature of the Controlled Firing Area, as compared to other special use airspace, is that its activities are suspended immediately when spotter aircraft, radar, or ground lookout positions indicate an aircraft might be approaching the area. There is no need to chart Controlled Firing Areas since they do not cause a nonparticipating aircraft to change its flight path.

117. PARACHUTE JUMP AIRCRAFT OPERATIONS

a. Procedures relating to parachute jump areas are contained in FAR—105. Tabulations of parachute jump areas in the U.S. are contained in the Airport/Facility Directory.

b. Pilots of aircraft engaged in parachute jump operations are reminded that all reported altitudes must be with reference to mean sea level, or flight level, as appropriate, to enable ATC to provide meaningful traffic information.

118—129. RESERVED

NOTES

Section 5. OTHER AIRSPACE AREAS

130. AIRPORT TRAFFIC AREAS

a. Unless otherwise specifically designated (FAR—93), Airport traffic areas consist of the airspace within a horizontal radius of 5 statute miles from the geographical center of any airport at which a control tower is operating, extending from the surface up to, but not including, an altitude of 3,000 feet above the elevation of the airport.

b. The rules prescribed for airport traffic areas are established in FAR—91.70, FAR—91.85, and FAR—91.87. They require, in effect, that unless a pilot is landing or taking off from an airport within the airport traffic area, *the pilot must avoid the area unless specifically authorized by ATC*, either directly from the ATC facility responsible for the airport traffic area, or from the facility from which the pilot is receiving radar services. When authorized by ATC to operate in an airport traffic area, the pilot may expect traffic advisory service on a workload-permitting basis.

c. Unless otherwise authorized, a pilot operating to or from an airport served by a control tower must: (1) establish and maintain radio communications with the tower prior to and while operating in the airport traffic area, (2) Maintain radio communications with the tower while operating on the movement areas of the airport. Maximum indicated airspeeds are prescribed. Airport traffic areas are indicated on VFR Navigation Charts by the blue airport symbol, but the actual boundary is not depicted. (See PARA—71 - GENERAL DIMENSIONS OF AIRSPACE SEGMENTS.)

131. AIRPORT ADVISORY AREA

a. The airport advisory area is the area within 10 statute miles of an airport where a control tower is not operating but where a FSS is located. At such locations, the FSS provides advisory service to arriving and departing aircraft. (See PARA—157 - TRAFFIC AIRPORT ADVISORY PRACTICES AT AIRPORTS WHERE A TOWER IS NOT IN OPERATION.)

b. It is not mandatory that pilots participate in the Airport Advisory Service program, but it is strongly recommended that they do.

132. MILITARY TRAINING ROUTES (MTR)

a. National security depends largely on the deterrent effect of our airborne military forces. To be proficient, the military services must train in a wide range of airborne tactics. One phase of this training involves "low level" combat tactics. The required maneuvers and high speeds are such that they may occasionally make the see-and-avoid aspect of VFR flight more difficult without increased vigilance in areas containing such operations. In an effort to ensure the greatest practical level of safety for all flight operations, the MTR program was conceived.

b. **The MTRs program is a joint venture by the FAA and the Department of Defense (DOD). MTR routes are mutually developed for use by the military for the purpose of conducting low-altitude, high-speed training. The routes above 1,500 feet above ground level (AGL) are developed to be flown, to the maximum extent possible, under IFR. The routes at 1,500 feet AGL and below are generally developed to be flown under Visual Flight Rules (VFR).**

c. **Generally, MTRs are established below 10,000 feet MSL for operations at speeds in excess of 250 knots. However, route segments may be defined at higher altitudes for purposes of route continuity. For example, route segments may be defined for descent, climbout, and mountainous terrain. There are IFR and VFR routes as follows:**

(1) IFR Military Training Routes — IR: Operations on these routes are conducted in accordance with IFRs regardless of weather conditions.

(2) VFR Military Training Routes — VR: Operations on these routes are conducted in accordance with VFRs.

d. Military training routes will be identified and charted as follows:

(1) Route identification.

(a) *IR and VR at or below 1,500 feet AGL* (with no segment above 1,500) will be identified by four digit numbers; e.g., IR 1006, VR 1007, etc.

(b) *IR and VR above 1,500 feet AGL* (segments of these routes may be below 1,500) will be identified by three digit numbers; e.g., IR 008, VR 009, etc.

(c) Alternate IR/VR routes or route segments are identified by using the basic/principal route designation followed by a letter suffix, e.g., IR008A, VR1007B, etc.

(2) Route charting.

(a) IFR Low Altitude En Route Chart — This chart will depict all IR routes and all VR routes that accommodate operations above 1,500 feet AGL.

(b) VFR Planning Chart — This chart will depict routes (military training activities such as IR and VR regardless of altitude@, MOAs, and restricted, warning and alert areas.

(c) Area Planning (AP/1B) Chart (DOD Flight Information Publication — FLIP. This chart is published by the DOD primarily for military users and contains detailed information on both IR and VR routes. (See PARA—625 - AUXILIARY CHARTS.)

e. The FLIP contains charts and narrative descriptions of these routes. This publication is available to the general public by single copy or annual subscription from the NOAA Distribution Branch, N/CG33 Riverdale, Maryland 20849. This DOD FLIP is available for pilot briefings at FSS and many airports.

f. Nonparticipating aircraft are not prohibited from flying within an MTR; however, extreme vigilance should be exercised when conducting flight through or near these routes. Pilots should contact FSSs within 100 NM of a particular MTR to obtain current information or route usage in their vicinity. Information available includes times of

scheduled activity, altitudes in use on each route segment, and actual route width. Route width varies for each MTR and can extend several miles on either side of the charted MTR centerline. Route width information for IR and VR MTR's is also available in the FLIP AP/1B along with additional MTR (SR/AR) information. When requesting MTR information, pilots should give the FSS their position, route of flight, and destination in order to reduce frequency congestion and permit the FSS specialist to identify the MTR routes which could be a factor.

133. TEMPORARY FLIGHT RESTRICTIONS

a. Temporary flight restrictions may be put into effect in the vicinity of any incident or event which by its nature may generate such a high degree of public interest that the likelihood of a hazardous congestion of air traffic exists. FAR—91.91, as amended, prohibits the operation of nonessential aircraft in airspace that has been designated in a NOTAM as an area within which temporary flight restrictions apply. This rule will be implemented in the case of disasters of substantial magnitude. It will also be implemented as necessary in the case of demonstrations, riots, and other civil disturbances, as well as major sporting events, parades, pageants, and similar functions which are likely to attract large crowds and encouraging viewing from the air. (See PARA—294 — NOTICE TO AIRMEN (NOTAM) SYSTEM.)

b. NOTAM's implementing temporary flight restrictions will contain a description of the area in which the restrictions apply. Normally the area will include the airspace below 2,000 feet above the surface within 5 miles of the site of the incident. However, the exact dimensions will be included in the NOTAM.

c. Pilots are not to operate aircraft within such an area described in the NOTAM unless they are one of the following:

(1) That aircraft is participating in disaster relief activities and is being operated under the direction of the agency responsible for relief activities;

(2) They are operating to or from an airport within the area and such operation will not hamper or endanger relief activities;

(3) Their operation is authorized under an IFR ATC clearance;

(4) Flight around the area is impracticable because of weather or other considerations and advance notice is given to the Air Traffic facility specified in the NOTAM and en route flight through the area will not hamper or endanger relief activities; or

(5) They are carrying accredited news representatives or persons on official business concerning the incident, and the flight is conducted in accordance with FAR—91.79 and a flight plan is filed with the Air Traffic facility specified in the NOTAM.

d. Flight Limitations in the proximity of Space Flight Operations are designated in a Notice to Airmen (NOTAM). FAR—91.102 provides protection from potentially hazardous situations for pilots and space flight crews and costly delays of shuttle operations.

e. Flight Restrictions in the proximity of Presidential and Other Parties are put into effect because numerous aircraft and large assemblies of persons may be attracted to areas to be visited or traveled by the President or Vice President, heads of foreign states, and other public figures. Such conditions may create a hazard to aircraft engaged in air commerce and to persons and property on the ground. In addition, responsible agencies of the United States Government may determine that certain regulatory actions should be taken in the interest of providing protection for these public figures. FAR—91.104 provides for the issuance of a regulatory NOTAM to establish flight restrictions where required in such cases.

134—149. RESERVED

Chapter 4. AIR TRAFFIC CONTROL

Section 1. SERVICES AVAILABLE TO PILOTS

150. AIR ROUTE TRAFFIC CONTROL CENTERS

Centers are established primarily to provide Air Traffic Service to aircraft operating on IFR flight plans within controlled airspace, and principally during the en route phase of flight.

151. CONTROL TOWERS

Towers have been established to provide for a safe, orderly and expeditious flow of traffic on and in the vicinity of an airport. When the responsibility has been so delegated, towers also provide for the separation of IFR aircraft in the terminal areas (See PARA—362 - APPROACH CONTROL.)

152. FLIGHT SERVICE STATIONS

FSSs are air traffic facilities which provide pilot briefings, en route communications and VFR search and rescue services, assist lost aircraft and aircraft in emergency situations, relay ATC clearances, originate Notices to Airmen, broadcast aviation weather and NAS information, receive and process IFR flight plans, and monitor NAVAIDS. In addition, at selected locations FSSs provide En Route Flight Advisory Service (Flight Watch), take weather observations, issue airport advisories, and advise Customs and Immigration of transborder flights.

153. RECORDING AND MONITORING

a. Calls to air traffic control (ATC) facilities (ARTCCs, Towers, FSSs, Central Flow, and Communications Control Centers) over radio and ATC operational telephone lines (lines used for operational purposes such as controller instructions, briefings, opening and closing flight plans, issuance of IFR clearances and amendments, counter hijacking activities, etc.) may be monitored and recorded for operational uses such as accident investigations, accident prevention, search and rescue purposes, specialist training and evaluation, and technical evaluation and repair of control and communications systems.

b. Where the public access telephone is recorded, a beeper tone is not required. In place of the "beep" tone the FCC has substituted a mandatory requirement that persons to be recorded be given notice they are to be recorded and give consent. Notice is given by this entry, consent to record is assumed by the individual placing a call to the operational facility.

154. COMMUNICATIONS RELEASE OF IFR AIRCRAFT LANDING AT AN AIRPORT NOT BEING SERVED BY AN OPERATING TOWER

Aircraft operating on an IFR flight plan, landing at an airport not being served by a tower will be advised to change to the airport advisory frequency when direct communications with ATC is no longer required. Towers and centers do not have nontower airport traffic and runway in use information. The instrument approach may not be aligned with the runway in use; therefore, if the information has not already been obtained, pilots should make an expeditious change to the airport advisory frequency when authorized. (See PARA—363-ADVANCE INFORMATION ON INSTRUMENT APPROACH.)

155. PILOT VISITS TO AIR TRAFFIC FACILITIES

Pilots are encouraged to visit air traffic facilities (Towers, Centers and FSSs) and participate in "Operation Raincheck". Operation Raincheck is a program designed to familiarize pilots with the ATC system, its functions, responsibilities and benefits. On rare occasions, facilities may not be able to approve a visit because of ATC workload or other reasons. It is therefore requested that pilots contact the facility prior to the visit and advise of the number of persons in the group, the time and date of the proposed visit and the primary interest of the group. With this information available, the facility can prepare an itinerary and have someone available to guide the group through the facility.

156. APPROACH CONTROL SERVICE FOR VFR ARRIVING AIRCRAFT

a. Numerous approach control facilities have established programs for arriving VFR aircraft to contact approach control for landing information. This information includes: wind, runway, and altimeter setting at the airport of intended landing. This information may be omitted if contained in the ATIS broadcast and the pilot states the appropriate ATIS code.

NOTE.— Pilot use of "have numbers" does not indicate receipt of the ATIS broadcast. In addition, the controller will provide traffic advisories on a workload permitting basis.

b. Such information will be furnished upon initial contact with concerned approach control facility. The pilot will be requested to change to the *tower* frequency at a predetermined time or point, to receive further landing information.

c. Where available, use of this procedure will not hinder the operation of VFR flights by requiring excessive spacing between aircraft or devious routing.

d. Compliance with this procedure is not mandatory but pilot participation is encouraged. (See PARA—165-TERMINAL RADAR PROGRAMS FOR VFR AIRCRAFT.)

157. TRAFFIC ADVISORY PRACTICES AT AIRPORTS WITHOUT OPERATING CONTROL TOWERS

a. Airport Operations Without Operating Control Tower

(1) There is no substitute for alertness while in the vicinity of an airport. It is essential that pilots be alert and look for other traffic and exchange traffic information when approaching or departing an airport without an operating control tower. This is of particular importance since other aircraft may not have communication capability or, in some cases, pilots may not communicate their presence or intentions when operating into or out of such airports. To achieve the greatest degree of safety, it is essential that all radio-equipped aircraft transmit/receive on a common frequency identified for the purpose of airport advisories.

(2) An airport may have a full or part-time tower or flight service station (FSS) located on the airport, a full or part-time UNICOM station or no aeronautical station at all. There are three ways for pilots to communicate their intention and obtain airport/traffic information when operating at an airport that does not have an operating tower: by communicating with an FSS, a UNICOM operator, or by making a self-announce broadcast.

b. Communicating on a Common Frequency.

(1) The key to communicating at an airport without an operating control tower is selection of the correct common frequency. The acronym *CTAF* which stands for Common Traffic Advisory Frequency, is synonymous with this program. A CTAF is a frequency designated for the purpose of carrying out airport advisory practices while operating to or from an airport without an operating control tower. The CTAF may be a UNICOM, MULTICOM, FSS, or tower frequency and is identified in appropriate aeronautical publications.

(2) The CTAF frequency for a particular airport is contained in the Airport/Facility Directory (A/FD), Alaska Supplement, Alaska Terminal Publication, Instrument Approach Procedure Charts, and Standard Instrument Departure (SID) charts. Also, the CTAF frequency can be obtained by contacting any FSS. Use of the appropriate CTAF, combined with a visual alertness and application of the following recommended good operating practices, will enhance safety of flight into and out of all uncontrolled airports.

c. Recommended Traffic Advisory Practices.

All inbound traffic should monitor and communicate as appropriate on the designated CTAF from 10 miles to landing. Departing aircraft should monitor/communicate on the appropriate frequency from start-up, during taxi, and until 10 miles from the airport unless the FARs or local procedures require otherwise.

d. Airport Advisory Service Provided by an FSS.

(1) Airport Advisory Service (AAS) is a service provided by an FSS physically located on an airport which does not have a control tower or where the tower is operated on a part-time basis. The CTAF for FSSs which provide this service will be disseminated in appropriate aeronautical publications.

(2) In communicating with a CTAF FSS, establish two-way communications before transmitting outbound/inbound intentions or information. An inbound aircraft should report approximately 10 miles from the airport, reporting altitude and aircraft type, location relative to the airport, state whether landing or overflight, and request airport advisory. Departing aircraft should state the aircraft type, full identification number, type of flight planned, i.e., VFR or IFR and the planned destination or direction of flight. Report before taxiing and before taxiing on the runway for departure. If communications with a UNICOM are necessary after initial report to FSS, return to FSS frequency for traffic update.

(a) Inbound

EXAMPLE:

VERO BEACH RADIO, CENTURION SIX NINER DELTA DELTA IS TEN MILES SOUTH, TWO THOUSAND, LANDING VERO BEACH. REQUEST AIRPORT ADVISORY.

(b) Outbound

EXAMPLE:

VERO BEACH RADIO, CENTURION SIX NINER DELTA DELTA, READY TO TAXI, VFR, DEPARTING TO THE SOUTHWEST. REQUEST AIRPORT ADVISORY.

(3) A CTAF FSS provides wind direction and velocity, favored or designated runway, altimeter setting, known traffic, notices to airmen, airport taxi routes, airport traffic pattern information, and instrument approach procedures. These elements are varied so as to best serve the current traffic situation. Some airport managers have specified that under certain wind or other conditions designated runways be used. Pilots should advise the FSS of the runway they intend to use.

CAUTION: All aircraft in the vicinity of an airport may not be in communication with the FSS.

e. Information Provided by Aeronautical Advisory Stations (UNICOM).

(1) UNICOM is a nongovernment air/ground radio communication station which may provide airport information at public use airports where there is no tower or FSS.

(2) On pilot request, UNICOM stations may provide pilots with weather information, wind direction, the recommended runway, or other necessary information. If the UNICOM frequency is designated as the CTAF, it will be identified in appropriate aeronautical publications.

(3) Should AAS by an FSS or, Aeronautical Advisory Station (UNICOM) be unavailable, wind and weather information may be obtainable from nearby controlled airports via Automatic Terminal Information Service (ATIS) or Automated Weather Observing System (AWOS) frequency.

f. Self-Announce Position and/or Intentions.

(1) General. *Self-announce* is a procedure whereby pilots broadcast their position or intended flight activity or ground operation on the designated CTAF. This procedure is used primarily at airports which do not have an FSS on the airport. The self-announce procedure should also be used if a pilot is unable to communicate with the FSS on the designated CTAF.

(2) If an airport has a tower and it is temporarily closed, or operated on a part-time basis and there is no FSS on the airport or the FSS is closed, use the CTAF to self-announce your position or intentions.

(3) Where there is no tower, FSS, or UNICOM station on the airport, use MULTICOM frequency 122.9 for self-announce procedures. Such airports will be identified in appropriate aeronautical information publications.

(4) Practice Approaches. Pilots conducting practice instrument approaches should be particularly alert for other aircraft that may be departing in the opposite direction. When conducting any practice approach, regardless of its direction relative to other airport operations, pilots should make announcements on the CTAF as follows:

(a) departing the final approach fix, inbound;

(b) established on the final approach segment or immediately upon being released by ATC;

(c) upon completion or termination of the approach; and

(d) upon executing the missed approach procedure.

(5) Departing aircraft should always be alert for arrival aircraft coming from the opposite direction.

(6) Recommended Self—Announce Phraseologies: It should be noted that aircraft operating to or from another nearby airport may be making self-announce broadcasts on the same UNICOM or MULTICOM frequency. To help identify one airport from another, the airport name should be spoken at the beginning and end of each self-announce transmission.

(a) Inbound

EXAMPLE:

STRAWN TRAFFIC, APACHE TWO TWO FIVE ZULU, (POSITION), (ALTITUDE), (DESCENDING) OR ENTERING DOWNWIND/BASE/FINAL (AS APPROPRIATE) RUNWAY ONE SEVEN FULL STOP, TOUCH-AND-GO, STRAWN.

STRAWN TRAFFIC APACHE TWO TWO FIVE ZULU LEAVING RUNWAY ONE SEVEN STRAWN.

(b) Outbound

EXAMPLE:

STRAWN TRAFFIC, QUEEN AIR SEVEN ONE FIVE FIVE BRAVO (LOCATION ON AIRPORT) TAXIING TO RUNWAY TWO SIX STRAWN.

STRAWN TRAFFIC, QUEEN AIR SEVEN ONE FIVE FIVE BRAVO DEPARTING RUNWAY TWO SIX. "DEPARTING THE PATTERN TO THE (DIRECTION), CLIMBING TO (ALTITUDE) STRAWN."

(c) Practice Instrument Approach

EXAMPLE:

STRAWN TRAFFIC, CESSNA TWO ONE FOUR THREE QUEBEC (NAME - FINAL APPROACH FIX) INBOUND DESCENDING THROUGH (ALTITUDE) PRACTICE (TYPE) APPROACH RUNWAY THREE FIVE STRAWN.

STRAWN TRAFFIC, CESSNA TWO ONE FOUR THREE QUEBEC PRACTICE (TYPE) APPROACH COMPLETED OR TERMINATED RUNWAY THREE FIVE STRAWN.

g. UNICOM Communications Procedures.

(1) In communicating with a UNICOM station, the following practices will help reduce frequency congestion, facilitate a better understanding of pilot intentions, help identify the location of aircraft in the traffic pattern, and enhance safety of flight:

(a) Select the correct UNICOM frequency.

(b) State the identification of the UNICOM station you are calling in each transmission.

(c) Speak slowly and distinctly.

(d) Report approximately 10 miles from the airport, reporting altitude, and state your aircraft type, aircraft idenification, location relative to the airport, state whether landing or overflight, and request wind information and runway in use.

(e) Report on downwind, base, and final approach.

(f) Report leaving the runway.

(2) Recommended UNICOM Phraseologies:

(a) Inbound

EXAMPLE:

FREDERICK UNICOM CESSNA EIGHT ZERO ONE TANGO FOXTROT 10 MILES SOUTHEAST DESCENDING THROUGH (ALTITUDE) LANDING FREDERICK, REQUEST WIND AND RUNWAY INFORMATION FREDERICK.

FREDERICK TRAFFIC CESSNA EIGHT ZERO ONE TANGO FOXTROT ENTERING DOWNWIND/BASE/FINAL (AS APPROPRIATE) FOR RUNWAY ONE NINE FULL STOP, TOUCH-AND-GO FREDERICK.

FREDERICK TRAFFIC CESSNA EIGHT ZERO ONE TANGO FOXTROT LEAVING RUNWAY ONE NINE FREDERICK.

(b) Outbound

EXAMPLE:

FREDERICK UNICOM CESSNA EIGHT ZERO ONE TANGO FOXTROT (LOCATION ON AIRPORT) TAXIING TO RUNWAY ONE NINE, REQUEST WIND AND TRAFFIC INFORMATION FREDERICK.

FREDERICK TRAFFIC CESSNA EIGHT ZERO ONE TANGO FOXTROT DEPARTING RUNWAY ONE NINE. "REMAINING IN THE PATTERN" OR "DEPARTING THE PATTERN TO THE (DIRECTION) (AS APPROPRIATE)" FREDERICK.

SUMMARY OF RECOMMENDED COMMUNICATION PROCEDURES

	FACILITY AT AIRPORT	FREQUENCY USE	COMMUNICATION/BROADCAST PROCEDURES		
			OUTBOUND	*INBOUND*	*PRACTICE INSTRUMENT APPROACH*
1.	UNICOM (No Tower or FSS)	Communicate with UNICOM station on published CTAF frequency (122.7, 122.8, 122.725, 122.975, or 123.0). If unable to contact UNICOM station, use self-announce procedures on CTAF.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	
2.	No Tower, FSS, or UNICOM	Self-announce on MULTICOM frequency 122.9.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	Departing final approach fix (name) or on final approac segment inbound.
3.	No Tower in operation, FSS open	Communicate with FSS on CTAF frequency.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	Approach completed/ terminated.
4.	FSS closed (No Tower)	Self-announce on CTAF.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	
5.	Tower or FSS not in operation	Self-announce on CTAF.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	

158. IFR APPROACHES/GROUND VEHICLE OPERATIONS

a. IFR Approaches.

When operating in accordance with an IFR clearance and ATC approves a change to the advisory frequency, make an expeditious change to the CTAF and employ the recommended traffic advisory procedures.

b. Ground Vehicle Operation.

Airport ground vehicles equipped with radios should monitor the CTAF frequency when operating on the airport movement area and remain clear of runways/taxiways being used by aircraft. Radio transmissions from ground vehicles should be confined to safety-related matters.

c. Radio Control of Airport Lighting Systems.

Whenever possible, the CTAF will be used to control airport lighting systems at airports without operating control towers. This eliminates the need for pilots to change frequencies to turn the lights on and allows a continuous listening watch on a single frequency. The CTAF is published on the instrument approach chart and in other appropriate aeronautical information publications. For further details concerning radio controlled lights, see AC 150/5340.27.

159. DESIGNATED UNICOM/MULTICOM FREQUENCIES

a. Communications Between Aircraft.

CAUTION—The Federal Communications Commission (FCC) requires an aircraft station license to operate o UNICOM/MULTICOM frequencies and usage must be i accordance with Part 87 of the FCC Rules (See Sectio 87.29 regarding license applications). Misuse of these frequencies may result in either the imposition of fines and/ or revocation/suspension of FCC aircraft station license.

b. Frequency Use.

The following listing depicts UNICOM and MULTI

COM frequency uses as designated by the Federal Communications Commission (FCC).

FREQUENCY	USE
122.700	Airports without an operating control tower
122.725	Airports without an operating control tower
122.800	Airports without an operating control tower
123.000	Airports without an operating control tower
122.975	Airports without an operating control tower
122.900	(MULTICOM frequency) Airports with no tower, FSS, or UNICOM
122.950	Airports with a control tower
122.725	Private airports (not open to public)
122.975	High altitude
123.050	Heliports
123.075	Heliports

NOTE— In some areas of the country, frequency interference may be encountered from nearby airports using the same UNICOM frequency. Where this is a problem, UNICOM operators are encouraged to develop a *least interference* frequency assignment plan for airports concerned using the five frequencies designated for airports without operating control towers. UNICOM licensees may then request FCC to assign frequencies in accordance with the plan, which they will review and consider for approval.

160. USE OF UNICOM FOR ATC PURPOSES

UNICOM service may be used for air traffic control purposes, only under the following circumstances:

(1) Revision to proposed departure time.

(2) Takeoff, arrival, or flight plan cancellation time.

(3) ATC clearance, provided arrangements are made between the ATC facility and the UNICOM licensee to handle such messages.

161. AUTOMATIC TERMINAL INFORMATION SERVICE (ATIS)

a. ATIS is the continuous broadcast of recorded noncontrol information in selected high activity terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information. Pilots are urged to cooperate in the ATIS program as it relieves frequency congestion on approach control, ground control, and local control frequencies. The Airport Facility/Directory indicates airports for which ATIS is provided.

b. ATIS information includes the time of the latest weather sequence, ceiling, visibility (if the weather is above a ceiling/sky condition of 5,000 feet and the visibility is 5 miles or more, inclusion of the ceiling/sky condition, visibility, and obstructions to vision in the ATIS message is optional), obstructions to visibility, temperature, dew point (if available), wind direction (magnetic) and velocity, altimeter, other pertinent remarks, instrument approach and runways in use is continuously broadcast on the voice feature of a TVOR/VOR/VORTAC located on or near the airport, or in a discrete VHF/UHF frequency. The departure runway will only be given if different from the landing runway except at locations having a separate ATIS for departure. Where VFR arrival aircraft are expected to make initial contact with approach control, this fact and the appropriate frequencies may be broadcast on ATIS. Pilots of aircraft arriving or departing the terminal area can receive the continuous ATIS broadcasts at times when cockpit duties are least pressing and listen to as many repeats as desired. ATIS broadcasts shall be updated upon the receipt of any official weather, regardless of content change and reported values. A new recording will also be made when there is a change in other pertinent data such as runway change, instrument approach in use, etc.

EXAMPLE:

DULLES INTERNATIONAL INFORMATION SIERRA. 1300 UTC WEATHER. MEASURED CEILING THREE THOUSAND OVERCAST. VISIBILITY THREE, SMOKE. TEMPERATURE SIX EIGHT. WIND THREE FIVE ZERO AT EIGHT. ALTIMETER TWO NINER NINER TWO. ILS RUNWAY ONE RIGHT APPROACH IN USE. LANDING RUNWAY ONE RIGHT AND LEFT. DEPARTURE RUNWAY THREE ZERO. ARMEL VORTAC OUT OF SERVICE. ADVISE YOU HAVE SIERRA.

c. Pilots should listen to ATIS broadcasts whenever ATIS is in operation.

d. Pilots should notify controllers on initial contact that they have received the ATIS broadcast by repeating the alphabetical code word appended to the broadcast.

EXAMPLE:

"INFORMATION SIERRA RECEIVED."

e. When the pilot acknowledges that he has received the ATIS broadcast, controllers may omit those items contained in the broadcast if they are current. Rapidly changing conditions will be issued by ATC and the ATIS will contain words as follows:

EXAMPLE:

"LATEST CEILING/VISIBILITY/ALTIMETER/WIND/(other conditions) WILL BE ISSUED BY APPROACH CONTROL/TOWER."

NOTE.— The absence of a sky condition or ceiling and/or visibility on ATIS indicates a sky condition or ceiling of 5,000 feet or above and visibility of 5 miles or more. A remark may be made on the broadcast, "The weather is better than 5000 and 5," or the existing weather may be broadcast.

f. Controllers will issue pertinent information to pilots who do not acknowledge receipt of a broadcast or who acknowledge receipt of a broadcast which is not current.

g. To serve frequency limited aircraft, FSSs are equipped to transmit on the omnirange frequency at most en route VORs used as ATIS voice outlets. Such communication interrupts the ATIS broadcast. Pilots of aircraft equipped to receive on other FSS frequencies are encouraged to do so in order that these override transmissions may be kept to an absolute minimum.

h. While it is a good operating practice for pilots to make use of the ATIS broadcast where it is available, some pilots use the phrase "Have Numbers" in communications with the control tower. Use of this phrase means that the pilot has received wind, runway, and altimeter information ONLY and the tower does not have to repeat this informa-

tion. It does not indicate receipt of the ATIS broadcast and should never be used for this purpose.

162. RADAR TRAFFIC INFORMATION SERVICE

This is a service provided by radar ATC facilities. Pilots receiving this service are advised of any radar target observed on the radar display which may be in such proximity to the position of their aircraft or its intended route of flight that it warrants their attention. This service is not intended to relieve the pilot of his responsibility for continual vigilance to see and avoid other aircraft.

a. Purpose of the Service:

(1) The issuance of traffic information as observed on a radar display is based on the principle of assisting and advising a pilot that a particular radar target's position and track indicates it may intersect or pass in such proximity to his intended flight path that it warrants his attention. This is to alert the pilot to the traffic so that he can be on the lookout for it and thereby be in a better position to take appropriate action should the need arise.

(2) Pilots are reminded that the surveillance radar used by ATC does not provide altitude information unless the aircraft is equipped with MODE C and the Radar Facility is capable of displaying altitude information.

b. Provisions of the Service:

(1) Many factors, such as limitations of the radar, volume of traffic, controller workload and communications frequency congestion, could prevent the controller from providing this service. The controller possesses complete discretion for determining whether he is able to provide or continue to provide this service in a specific case. His reason against providing or continuing to provide the service in a particular case is not subject to question nor need it be communicated to the pilot. In other words, the provision of this service is entirely dependent upon whether the controller believes he is in a position to provide it. Traffic information is routinely provided to all aircraft operating on IFR Flight Plans except when the pilot advises he does not desire the service, or the pilot is operating within positive controlled airspace. Traffic information may be provided to flights not operating on IFR Flight Plans when requested by pilots of such flights.

NOTE.— Radar ATC facilities normally display and monitor both primary and secondary radar when it is available, except that secondary radar may be used as the sole display source in Positive Control Airspace (PCA), and under some circumstances outside of PCA (beyond primary coverage and in en route areas where only secondary is available). Secondary radar may also be used outside PCA as the sole display source when the primary radar is temporarily unusable or out of service. Pilots in contact with the affected ATC facility are normally advised when a temporary outage occurs; i.e., "primary radar out of service; traffic advisories available on transponder aircraft only." This means simply that only the aircraft which have transponders installed and in use will be depicted on ATC radar indicators when the primary radar is temporarily out of service.

(2) When receiving VFR radar advisory service, pilots should monitor the assigned frequency at all times. This is to preclude controllers' concern for radio failure or emergency assistance to aircraft under his jurisdiction. VFR radar advisory service does not include vectors away from conflicting traffic unless requested by the pilot. When advisory service is no longer desired, advise the controller before changing frequencies and then change your transponder code to 1200, if applicable. Pilots should also inform the controller when changing VFR cruising altitude. Except in programs where radar service is automatically terminated, the controller will advise the aircraft when radar is terminated.

NOTE.— Participation by VFR pilots in formal programs implemented at certain terminal locations constitutes pilot request. This also applies to participating pilots at those locations where arriving VFR flights are encouraged to make their first contact with the tower on the approach control frequency.

c. Issuance of Traffic Information — Traffic information will include the following concerning a target which may constitute traffic for an aircraft that is:

(1) Radar identified:

(a) Azimuth from the aircraft in terms of the 12 hour clock, or

(b) When rapidly maneuvering civil test or military aircraft prevent accurate issuance of traffic as in (a) above, specify the direction from an aircraft's position in terms of the eight cardinal compass points (N,NE,E,SE,S,SW,W,NW). This method shall be terminated at the pilot's request.

(c) Distance from the aircraft in nautical miles;

(d) Direction in which the target is proceeding; and

(e) Type of aircraft and altitude if known.

EXAMPLE:

Traffic 10 o'clock, 3 miles, west-bound (type aircraft and altitude, if known, of the observed traffic). The altitude may be known, by means of MODE C, but not verified with the pilot for accuracy. (To be valid for separation purposes by ATC, the accuracy of MODE C readouts must be verified. This is usually accomplished upon initial entry into the radar system by a comparison of the readout to pilot stated altitude, or the field elevation in the case of continuous readout being received from an aircraft on the airport.) When necessary to issue traffic advisories containing unverified altitude information, the controller will issue the advisory in the same manner as if it were verified due t the accuracy of these readouts. The pilot may upon receipt of traffic information, request a vector (heading to avoid such traffic. The vector will be provided to th extent possible as determined by the controller provided the aircraft to be vectored is within the airspac under the jurisdiction of the controller.

(2) Not radar identified:

(a) Distance and direction with respect to a fix;

(b) Direction in which the target is proceeding; an

(c) Type of aircraft and altitude if known.

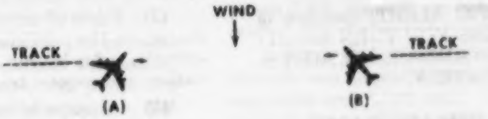
EXAMPLE:

Traffic 8 miles south of the airport northeastbound (type aircraft and altitude if known).

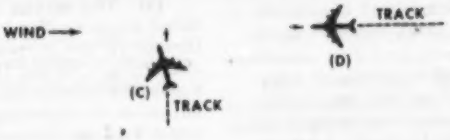
d. The examples depicted in the following figures poi out the possible error in the position of this traffic when is necessary for a pilot to apply drift correction to maintai this track. This error could also occur in the event change in course is made at the time radar traffic informa tion is issued.

(1) In this figure traffic information would be issu to the pilot of aircraft "A" as 12 o'clock. The actual po

tion of the traffic as seen by the pilot of aircraft "A" would be 2 o'clock. Traffic information issued to aircraft "B" would also be given as 12 o'clock, but in this case, the pilot of "B" would see his traffic at 10 o'clock.



(2) In this figure traffic information would be issued to the pilot of aircraft "C" as 2 o'clock. The actual position of the traffic as seen by the pilot of aircraft "C" would be 3 o'clock. Traffic information issued to aircraft "D" would be at an 11 o'clock position. Since it is not necessary for the pilot of aircraft "D" to apply wind correction (crab) to make good his track, the actual position of the traffic issued would be correct. Since the radar controller can only observe aircraft track (course) on his radar display, he must issue traffic advisories accordingly, and pilots should give due consideration to this fact when looking for reported traffic.



163. SAFETY ALERT

A safety alert will be issued to pilots of aircraft being controlled by ATC if the controller is aware the aircraft is at an altitude which, in the controller's judgment, places the aircraft in unsafe proximity to terrain, obstructions or other aircraft. The provision of this service is contingent upon the capability of the controller to have an awareness of a situation involving unsafe proximity to terrain, obstructions and uncontrolled aircraft. The issuance of a safety alert cannot be mandated, but it can be expected on a reasonable, though intermittent basis. Once the alert is issued, it is solely the pilot's prerogative to determine what course of action, if any, he will take. This procedure is intended for use in time critical situations where aircraft safety is in question. Noncritical situations should be handled via the normal traffic alert procedures.

a. Terrain or Obstruction Alert:

(1) The controller will immediately issue an alert to the pilot of an aircraft under his control when he recognizes that the aircraft is at an altitude which, in his judgment, may be in unsafe proximity to terrain/obstructions. The primary method of detecting unsafe proximity is through MODE C automatic altitude reports.

EXAMPLE:

LOW ALTITUDE ALERT, CHECK YOUR ALTITUDE IMMEDIATELY. THE, as appropriate, MEA/MVA/MOCA IN YOUR AREA IS (altitude) or, if past the final approach fix, THE, as appropriate, MDA/DH (if known) IS (altitude).

(2) Terminal ARTS-III facilities have an automated function which, if operating, alerts the controller when a tracked MODE C equipped aircraft under his control is below or is predicted to be below a predetermined minimum safe altitude. This function, called Minimum Safe Altitude Warning (MSAW), is designed solely as a controller aid in detecting potentially unsafe aircraft proximity to terrain/obstructions. The ARTS-III facility will, when MSAW is operating, provide MSAW monitoring for all aircraft with an operating MODE C altitude encoding transponder that are tracked by the system and are:

(a) Operating on an IFR flight plan, or

(b) Operating VFR and have requested MSAW monitoring.

(3) Terminal AN/TPX-42A (number beacon decoder system) facilities have an automated function called Low Altitude Alert System (LAAS). Although not as sophisticated as MSAW, LAAS alerts the controller when a MODE C transponder equipped aircraft operating on an IFR flight plan is below a predetermined minimum safe altitude.

NOTE.— Pilots operating VFR may request MSAW or LAAS monitoring if their aircraft are equipped with MODE C transponders.

EXAMPLE:

APACHE THREE THREE PAPA REQUEST MSAW/LAAS.

b. Aircraft Conflict Alert:

(1) The controller will immediately issue an alert to the pilot of an aircraft under his control if he is aware of another aircraft which is not under his control is at an altitude which, in the controller's judgment, places both aircraft in unsafe proximity to each other. With the alert, when feasible, the controller will offer the pilot the position of the traffic if time permits and an alternate course(s) of action. Any alternate course(s) of action the controller may recommend to the pilot will be predicated only on other traffic under his control.

EXAMPLE:

AMERICAN THREE, TRAFFIC ALERT, (position of traffic, if time permits), ADVISE YOU TURN RIGHT/LEFT HEADING (degrees) AND/OR CLIMB/DESCEND TO (altitude) IMMEDIATELY.

164. RADAR ASSISTANCE TO VFR AIRCRAFT

a. Radar equipped FAA ATC facilities provide radar assistance and navigation service (vectors) to VFR aircraft provided the aircraft can communicate with the facility, are within radar coverage, and can be radar identified.

b. Pilots should clearly understand that authorization to proceed in accordance with such radar navigational assistance does not constitute authorization for the pilot to violate FARs. In effect, assistance provided is on the basis that navigational guidance information issued is advisory in nature and the job of flying the aircraft safely, remains with the pilot.

c. In many cases, the controller will be unable to determine if flight into instrument conditions will result from his instructions. To avoid possible hazards resulting from being vectored into IFR conditions, pilots should keep the controller advised of the weather conditions in which he is operating and along the course ahead.

d. Radar navigation assistance (vectors) may be initiated by the controller when one of the following conditions exist:

(1) The controller suggests the vector and the pilot concurs.

(2) A special program has been established and vectoring service has been advertised.

(3) In the controller's judgment the vector is necessary for air safety.

e. Radar navigation assistance (vectors) and other radar derived information may be provided in response to pilot requests. Many factors, such as limitations of radar, volume of traffic, communications frequency, congestion, and controller workload could prevent the controller from providing it. The controller has complete discretion for determining if he is able to provide the service in a particular case. His decision not to provide the service in a particular case is not subject to question.

165. TERMINAL RADAR PROGRAMS FOR VFR AIRCRAFT

a. Basic Radar Service

(1) In addition to the use of radar for the control of IFR aircraft, all commissioned radar facilities provide traffic advisories and limited vectoring (on a workload permitting basis) to VFR aircraft.

NOTE.— When the STAGE services were developed, two basic radar services (traffic advisories and limited vectoring) were identified as STAGE I. This definition became, over the years, unnecessary. Therefore, the term STAGE I has been eliminated from use in the field and the handbooks. These basic services will still be provided by all commissioned terminal radar facilities whether they are STAGE II, III, or neither.

(2) Vectoring service may be provided when requested by the pilot or with pilot concurrence when suggested by ATC.

(3) Pilots of arriving aircraft should contact approach control on the publicized frequency and give their position, altitude, radar beacon code (if transponder equipped), destination, and request traffic information.

(4) Approach control will issue wind and runway, except when the pilot states "HAVE NUMBERS" or this information is contained in the ATIS broadcast and the pilot indicates he has received the ATIS information. Traffic information is provided on a workload permitting basis. Approach control will specify the time or place at which the pilot is to contact the tower on local control frequency for further landing information. Upon being told to contact the tower, radar service is automatically terminated.

b. Stage II Service (Radar Advisory and Sequencing for VFR Aircraft)

(1) This service has been implemented at certain terminal locations (See locations listed in the Airport/Facility Directory). The purpose of the service is to adjust the flow of arriving VFR and IFR aircraft into the traffic pattern in a safe and orderly manner and to provide radar traffic information to departing VFR aircraft. Pilot participation is urged but it is not mandatory.

(2) Pilots of arriving VFR aircraft should initiate radio contact on the publicized frequency with approach control when approximately 25 miles from the airport at which Stage II services are being provided. On initial contact by VFR aircraft, approach control will assume that Stage II service is requested. Approach control will provide the pilot with wind and runway (except when the pilot states "HAVE NUMBERS" or that he has received the ATIS information), routings, etc., as necessary for proper sequencing with other participating VFR and IFR traffic en route to the airport. Traffic information will be provided on a workload permitting basis. If an arriving aircraft does not want the service, the pilot should state "NEGATIVE STAGE II" or make a similar comment, on initial contact with approach control.

(3) After radar contact is established, the pilot may navigate on his own into the traffic pattern or, depending on traffic conditions, may be directed to fly specific headings to position the flight behind a preceding aircraft in the approach sequence. When a flight is positioned behind the preceding aircraft and the pilot reports having that aircraft in sight, he will be directed to follow it. If other "non-participating" or "local" aircraft are in the traffic pattern, the tower will issue a landing sequence. Radar service will be continued to the runway.

(4) Standard radar separation will be provided between IFR aircraft until such time as the aircraft is sequenced and the pilot sees the traffic he is to follow. Standard radar separation between VFR or between VFR and IFR aircraft will not be provided.

(5) Pilots of departing VFR aircraft are encouraged to request radar traffic information by notifying ground control on initial contact with their request and proposed direction of flight.

EXAMPLE:

XRAY GROUND CONTROL, NOVEMBER ONE EIGHT SIX, READY TO TAXI, VFR SOUTHBOUND.

HAVE INFORMATION BRAVO AND REQUEST RADAR TRAFFIC INFORMATION.

NOTE.— Following takeoff, the tower will advise when to contact departure control.

(6) Pilots of aircraft transiting the area and in radar contact/communication with approach control will receive traffic information on a controller workload permitting basis. Pilots of such aircraft should give their position, altitude, radar beacon code (if transponder equipped), destination, and/or route of flight.

c. Stage III Service (Radar Sequencing and Separation Service for VFR Aircraft).

(1) This service has been implemented at certain terminal locations. The service is advertised in the Airport/Facility Directory. The purpose of this service is to provide separation between all participating VFR aircraft and all IFR aircraft operating within the airspace defined as the Terminal Radar Service Area (TRSA). Pilot participation is urged but it is not mandatory.

(2) If any aircraft does not want the service, the pilot should state "NEGATIVE STAGE III" or make a similar comment, on initial contact with approach control or ground control, as appropriate.

(3) TRSAs are depicted on sectional aeronautical charts. A complete list of TRSA locations is contained in PARA. 166.

(4) While operating within a TRSA, pilots are provided Stage III service and separation as prescribed in this paragraph. In the event of a radar outage, separation and sequencing of VFR aircraft will be suspended as this service is dependent on radar. The pilot will be advised that the service is not available and issued wind, runway information, and the time or place to contact the tower. Traffic information will be provided on a workload permitting basis.

(5) Visual separation is used when prevailing conditions permit and it will be applied as follows:

(a) When a VFR flight is positioned behind the preceding aircraft and the pilot reports having that aircraft in sight, he will be directed to follow it. Radar service will be continued to the runway.

(b) When IFR flights are being sequenced with other traffic and the pilot reports the aircraft he is to follow in sight, the pilot may be directed to follow it and will be cleared for a "visual approach."

(c) If other "nonparticipating" or "local" aircraft are in the traffic pattern, the tower will issue a landing sequence.

(d) Departing VFR aircraft may be asked if they can visually follow a preceding departure out of the TRSA. If the pilot concurs, he will be directed to follow it until leaving the TRSA.

(6) Until visual separation is obtained, standard vertical or radar separation will be provided.

(a) 1000 feet vertical separation may be used between IFR aircraft.

(b) 500 feet vertical separation may be used between VFR aircraft, or between a VFR and an IFR aircraft.

(c) Radar separation varies depending on size of aircraft and aircraft distance from the radar antenna. The minimum separation used will be 1 1/2 miles for most VFR aircraft under 12,500 pounds GWT. If being separated from larger aircraft, the minimum is increased appropriately.

(7) Pilots operating VFR under Stage III in a TRSA—

(a) Must maintain an altitude when assigned by ATC unless the altitude assignment is to maintain at or below a specified altitude. ATC may assign altitudes for separation that do not conform to FAR—91.109. When the altitude assignment is no longer needed for separation or when leaving the TRSA, the instruction will be broadcast, "RESUME APPROPRIATE VFR ALTITUDES." Pilots must then return to an altitude that conforms to FAR—91.109 as soon as practicable.

(b) When not assigned an altitude, the pilot should coordinate with ATC prior to any altitude change.

(8) Within the TRSA, traffic information on observed but unidentified targets will, to the extent possible, be provided all IFR and participating VFR aircraft. At the request of the pilot, he will be vectored to avoid the observed traffic, insofar as possible, provided the aircraft to be vectored is within the airspace under the jurisdiction of the controller.

(9) Departing aircraft should inform ATC of their intended destination and/or route of flight and proposed cruising altitude.

(10) ATC will normally advise participating VFR aircraft when leaving the geographical limits of the TRSA. Radar service is not automatically terminated with this advisory unless specifically stated by the controller.

d. PILOT RESPONSIBILITY: THESE PROGRAMS ARE NOT TO BE INTERPRETED AS RELIEVING PILOTS OF THEIR RESPONSIBILITIES TO SEE AND AVOID OTHER TRAFFIC OPERATING IN BASIC VFR WEATHER CONDITIONS, TO ADJUST THEIR OPERATIONS AND FLIGHT PATH AS NECESSARY TO PRECLUDE SERIOUS WAKE ENCOUNTERS, TO MAINTAIN APPROPRIATE TERRAIN AND OBSTRUCTION CLEARANCE, OR TO REMAIN IN WEATHER CONDITIONS EQUAL TO OR BETTER THAN THE MINIMA REQUIRED BY FAR—91.105. WHENEVER COMPLIANCE WITH AN ASSIGNED ROUTE, HEADING AND/OR ALTITUDE IS LIKELY TO COMPROMISE PILOT RESPONSIBILITY RESPECTING TERRAIN AND OBSTRUCTION CLEARANCE, VORTEX EXPOSURE, AND WEATHER MINIMA, APPROACH CONTROL SHOULD BE SO ADVISED AND A REVISED CLEARANCE OR INSTRUCTION OBTAINED.

166. TERMINAL RADAR SERVICE AREAS (TRSAs)

STATE	CITY
ALABAMA	Birmingham, Huntsville, Mobile, Montgomery
ALASKA	Anchorage
ARIZONA	Phoenix, Tucson
ARKANSAS	Ft. Smith, Little Rock
CALIFORNIA	Burbank, Castle AFB (Merced), Monterey, Oakland, Ontario, Palm Springs, Sacramento, Diego, Santa Ana
COLORADO	Colorado Springs
CONNECTICUT	Windsor Locks (Bradley)
FLORIDA	Daytona Beach, Ft. Lauderdale, Jacksonville, Orlando, Pensacola, Tallahassee, Tampa, Palm Beach
GEORGIA	Augusta, Columbus, Macon, Savannah
HAWAII	Kahului
IDAHO	Boise
ILLINOIS	Champaign, Moline, Peoria, Rockford, Springfield
INDIANA	Evansville, Ft. Wayne, Indianapolis, South Bend
IOWA	Cedar Rapids, Des Moines
KANSAS	Wichita
KENTUCKY	Cincinnati (Covington), Lexington, Louisville
LOUISIANA	Baton Rouge, Lafayette, Lake Charles, Monroe, Shreveport
MAINE	Bangor, Portland
MICHIGAN	Flint, Grand Rapids, Kalamazoo, Lansing, Muskegon, Saginaw
MINNESOTA	Rochester
MISSISSIPPI	Columbus AFB, Gulfport, Jackson
MONTANA	Billings, Great Falls
NEBRASKA	Lincoln, Omaha
NEVADA	Reno
NEW JERSEY	Atlantic City
NEW MEXICO	Albuquerque
NEW YORK	Albany, Binghamton, Buffalo, Elmira, Islip, Rochester, Rome, Syracuse
NORTH CAROLINA	Asheville, Charlotte, Fayetteville, Greensboro, Raleigh-Durham, Wilmington
NORTH DAKOTA	Fargo
OHIO	Akron-Canton, Dayton, Toledo, Youngstown
OKLAHOMA	Altus, Oklahoma City, Tulsa
OREGON	Portland
PENNSYLVANIA	Allentown, Erie, Harrisburg, Wilkes-Barre
PUERTO RICO	San Juan
RHODE ISLAND	Providence
SOUTH CAROLINA	Charleston, Columbia, Greer, Shaw AFB (Sumter)
SOUTH DAKOTA	Sioux Falls
TENNESSEE	Bristol, Chattanooga, Knoxville, Memphis, Nashville
TEXAS	Amarillo, Abilene, Beaumont, Corpus Christi, Del Rio (Laughlin AFB), El Paso, Longvi Lubbock, Midland, San Antonio
UTAH	Salt Lake City
VERMONT	Burlington
VIRGINIA	Dulles, Norfolk, Richmond, Roanoke
WASHINGTON	Spokane, Tacoma, NAS Whidbey Island
WEST VIRGINIA	Charleston, Huntington
WISCONSIN	Green Bay, Madison, Milwaukee

A number of facilities with charted TRSAs have found it necessary to temporarily suspend or curtail Stage service. Pilots should consult NOTAMs for the latest information on services available. Pilots should also be aw that some TRSAs underlie or are adjacent to TCAs.

167. TOWER EN ROUTE CONTROL (TEC)

a. TEC is an ATC program to provide a service to aircraft proceeding to and from metropolitan areas. It links designated approach control areas by a network of identified routes made up of the existing airway structure of the National Airspace System. The FAA initiated an expanded TEC program to include as many facilities as possible. The program's intent is to provide an overflow resource in the low altitude system which would enhance ATC services. A few facilities have historically allowed turbojets to proceed between certain city pairs, such as Milwaukee and Chicago, via tower en route and these locations may continue service. However, the expanded TEC program will be plied, generally, for nonturbojet aircraft operating at below 10,000 feet. The program is entirely within the proach control airspace of multiple terminal facilities. sentially, it is for relatively short flights. Participat pilots are encouraged to use TEC for flights of two ho duration or less. If longer flights are planned, extensive ordination may be required within the multiple comp which could result in unanticipated delays.

b. Pilots requesting TEC are subject to the same de factor at the destination airport as other aircraft in

ATC system. In addition, departure and en route delays may occur depending upon individual facility workload. When a major metropolitan airport is incurring significant delays, pilots in the TEC program may want to consider an alternative airport experiencing no delay.

c. There are no unique requirements upon pilots to use the TEC program. Normal flight plan filing procedures will ensure proper flight plan processing. Pilots should include the acronym "TEC" in the remarks section of the flight plan when requesting tower en route. Pictorial and specific route descriptions are published in the Airport/Facility Directory (A/FD).

d. All approach controls in the system may not operate up to the maximum TEC altitude of 10,000 feet. The highest altitude available between any city pair is identified in the A/FD and may be revised in subsequent editions. Additionally, not all airports within an approach control's area are listed. IFR flight may be planned to any satellite airport in proximity to the major primary airport via the same routing (see A/FD for details).

168—169. RESERVED

170. TRANSPONDER OPERATION

a. GENERAL

(1) Pilots should be aware that proper application of transponder operating procedures will provide both VFR and IFR aircraft with a higher degree of safety in the environment where high-speed closure rates are possible. Transponders substantially increase the capability of radar to see an aircraft and the MODE C feature enables the controller to quickly determine where potential traffic conflicts may exist. Even VFR pilots who are not in contact with ATC will be afforded greater protection from IFR aircraft and VFR aircraft which are receiving traffic advisories. Nevertheless, pilots should never relax their visual scanning vigilance for other aircraft.

(2) Air Traffic Control Radar Beacon System (ATCRBS) is similar to and compatible with military coded radar beacon equipment. Civil MODE A is identical to military MODE 3.

(3) Civil and military transponders should be adjusted to the "on" or normal operating position as late as practicable prior to takeoff and to "off" or "standby" as soon as practicable after completing landing roll unless the change to "standby" has been accomplished previously at the request of ATC. IN ALL CASES, WHETHER VFR OR IFR, THE TRANSPONDER SHOULD BE OPERATING WHILE AIRBORNE UNLESS OTHERWISE REQUESTED BY ATC.

(4) If a pilot on an IFR flight cancels his IFR flight plan prior to reaching his destination, he should adjust his transponder according to VFR operations.

(5) If entering a U.S. domestic control area from outside the U.S., the pilot should advise on first radio contact with a U.S. radar ATC facility that such equipment is available by adding "transponder" to the aircraft identification.

(6) It should be noted by all users of the ATC Transponders that the coverage they can expect is limited to "line of sight." Low altitude or aircraft antenna shielding by the aircraft itself may result in reduced range. Range can be improved by climbing to a higher altitude. It may be possible to minimize antenna shielding by locating the antenna where dead spots are only noticed during abnormal flight attitudes.

b. TRANSPONDER CODE DESIGNATION

(1) For ATC to utilize one or a combination of the 4096 discrete codes FOUR DIGIT CODE DESIGNATION will be used, e.g., code 2100 will be expressed as TWO ONE ZERO ZERO. Due to the operational characteristics of the rapidly expanding automated air traffic control system, THE LAST TWO DIGITS OF THE SELECTED TRANSPONDER CODE SHOULD ALWAYS READ "00" UNLESS SPECIFICALLY REQUESTED BY ATC TO BE OTHERWISE.

c. AUTOMATIC ALTITUDE REPORTING (MODE C)

(1) Some transponders are equipped with a MODE C automatic altitude reporting capability. This system converts aircraft altitude in 100 foot increments to coded digital information which is transmitted together with MODE C framing pulses to the interrogating radar facility. The manner in which transponder panels are designed differs, therefore, a pilot should be thoroughly familiar with the operation of his transponder so that ATC may realize its full capabilities.

(2) Adjust transponder to reply on the MODE A/3 code specified by ATC and, if equipped, to reply on MODE C with altitude reporting *capability activated* unless deactivation is directed by ATC or unless the installed aircraft equipment has not been tested and calibrated as required by FAR—91.36. If deactivation is required by ATC, turn off the altitude reporting feature of your transponder. An instruction by ATC to "STOP ALTITUDE SQUAWK, ALTITUDE DIFFERS (number of feet) FEET," may be an indication that your transponder is transmitting incorrect altitude information or that you have an incorrect altimeter setting. While an incorrect altimeter setting has no effect on the MODE C altitude information transmitted by your transponder (transponders are preset at 29.92), it would cause you to fly at an actual altitude different from your assigned altitude. When a controller indicates that an altitude readout is invalid, the pilot should initiate a check to verify that the aircraft altimeter is set correctly.

(3) Pilots of aircraft with operating MODE C altitude reporting transponders should report exact altitude or flight level to the nearest hundred foot increment when establishing initial contact with an ATC facility. Exact altitude or flight level reports on initial contact provide ATC with information that is required prior to using MODE C altitude information for separation purposes. This will significantly reduce altitude verification requests.

d. TRANSPONDER IDENT FEATURE

(1) The transponder shall be operated only as specified by ATC. Activate the "IDENT" feature only upon request of the ATC controller.

e. CODE CHANGES

(1) When making routine code changes, pilots should avoid inadvertent selection of codes 7500, 7600 or 7700 thereby causing momentary false alarms at automated ground facilities. For example when switching from code 2700 to code 7200, switch first to 2200 then to 7200, NOT to 7700 and then 7200. This procedure applies to nondiscrete code 7500 and all discrete codes in the 7600 and 7700 series (i.e. 7600-7677, 7700-7777) which will trigger special indicators in automated facilities. Only nondiscrete code 7500 will be decoded as the hijack code.

(2) Under no circumstances should a pilot of a civil aircraft operate the transponder on Code 0001. This code is reserved for military interceptor operations.

(3) Military pilots operating VFR or IFR within restricted/warning areas should adjust their transponders to code 4000 unless another code has been assigned by ATC.

f. DEVIATIONS FROM TRANSPONDER REQUIREMENTS

(1) Specific details concerning requirements, exceptions and ATC authorized deviations for transponder and MODE C operation above 12,500 feet and below 18,000 feet MSL are found in FAR—91.24. In general, the FAR requires aircraft to be equipped with MODE A/3 (4096 codes) and MODE C altitude reporting capability when operating in controlled airspace of the 48 contiguous States and the District of Columbia above 12,500 feet MSL, excluding airspace at and below 2,500 feet AGL. Pilots should insure that their aircraft transponder is operating on an appropriate or ATC assigned VFR/IFR code and MODE C when operating in such airspace. If in doubt about the operational status of either feature of your transponder while airborne, contact the nearest ATC facility or FSS and they will advise you what facility you should contact for determining the status of your equipment. In-flight requests for "immediate" deviation may be approved by controllers only when the flight will continue IFR or when weather conditions prevent VFR descent and continued VFR flight in airspace not affected by the FAR. All other requests for deviation should be made by contacting the nearest Flight Service or Air Traffic facility in person or by telephone. The nearest ARTCC will normally be the controlling agency and is responsible for coordinating requests involving deviations in other ARTCC areas.

g. TRANSPONDER OPERATION UNDER VISUAL FLIGHT RULES (VFR)

(1) Unless otherwise instructed by an Air Traffic Control Facility, adjust Transponder to reply on MODE 3/A code 1200 regardless of altitude.

(2) Adjust transponder to reply on MODE C, with altitude reporting *capability activated* if the aircraft is so equipped, unless deactivation is directed by ATC or unless the installed equipment has not been tested and calibrated as required by FAR—91.36. If deactivation is required and your transponder is so designed, turn off the altitude reporting switch and continue to transmit MODE C framing pulses. If this capability does not exist, turn off MODE C.

h. RADAR BEACON PHRASEOLOGY

Air traffic controllers, both civil and military, will use the following phraseology when referring to operation of the Air Traffic Control Radar Beacon System (ATCRBS). Instructions by ATC refer only to MODE A/3 or MODE C operation and do not affect the operation of the transponder on other MODEs.

(1) **SQUAWK (number)** — Operate radar beacon transponder on designated code in MODE A/3.

(2) **IDENT** — Engage the "IDENT" feature (military I/P) of the transponder.

(3) **SQUAWK (number) and IDENT** — Oper transponder on specified code in MODE A/3 and eng the "IDENT" (military I/P) feature.

(4) **SQUAWK STANDBY** — Switch transponder standby position.

(5) **SQUAWK LOW/NORMAL** — Operate transp der on low or normal sensitivity as specified. Transpond is operated in "NORMAL" position unless ATC speci "LOW", ("ON" is used instead of "NORMAL" as a ma control label on some types of transponders.)

(6) **SQUAWK ALTITUDE** — Activate MODE C w automatic altitude reporting.

(7) **STOP ALTITUDE SQUAWK** — Turn off altitu reporting switch and continue transmitting MODE C fra ing pulses. If your equipment does not have this capabili turn off MODE C.

(8) **STOP SQUAWK (mode in use)** — Switch specified mode. (Used for military aircraft when the c troller is unaware of military service requirements for t aircraft to continue operation on another MODE.)

(9) **STOP SQUAWK** — Switch off transponder.

(10) **SQUAWK MAYDAY** — Operate transponder the emergency position (MODE A Code 7700 for civil tra ponder. MODE 3 Code 7700 and emergency feature military transponder.)

171. HAZARDOUS AREA REPORTING SERVICE

a. Selected FSSs provide flight monitoring where re larly traveled VFR routes cross large bodies of wa swamps, and mountains. This service is provided for t purpose of expeditiously alerting Search and Rescue fac ties when required.

(1) When requesting the service either in person, telephone or by radio, pilots should be prepared to give t following information — type of aircraft, altitude, indica airspeed, present position, route of flight, heading.

(2) Radio contacts are desired at least every 10 m utes. If contact is lost for more than 15 minutes, Sea and Rescue will be alerted. Pilots are responsible for c celling their request for service when they are outside t service area boundary. Pilots experiencing two-way ra failure are expected to land as soon as practicable a cancel their request for the service. The accompaning ill tration titled "LAKE, ISLAND, MOUNTAIN A SWAMP REPORTING SERVICE" depicts the areas a the FSS facilities involved in this program.

b. LONG ISLAND SOUND REPORTING SERVICE

The New York and Bridgeport FSSs provide Long Isla Sound Reporting service on request for aircraft travers Long Island Sound.

(1) When requesting the service pilots should ask SOUND REPORTING SERVICE and should be prepared provide the following appropriate information:

(a) Type and color of aircraft,

(b) The specific route and altitude across the sou including the shore crossing point,

(c) The overwater crossing time,

(d) Number of persons on board,

(e) True air speed.

(2) Radio contacts are desired at least every 10 minutes, however, for flights of shorter duration a midsound report is requested. If contact is lost for more than 15 minutes Search and Rescue will be alerted. Pilots are responsible for cancelling their request for the Long Island Sound Reporting Service when outside the service area boundary. Aircraft experiencing radio failure will be expected to land as soon as practicable and cancel their request for the service.

(3) COMMUNICATIONS: Primary communications—pilots are to transmit on 122.1 MHz and listen on one of the following VOR frequencies:

(a) NEW YORK FSS CONTROLS:

1. Hampton VORTAC (FSS transmits on 113.6 and receives on 122.1 MHz).

2. Calverton VORTAC (FSS transmits on 117.2 and receives on standard FSS frequencies).

3. Kennedy VORTAC (FSS transmits on 115.9 and receives on 122.1 MHz).

(b) BRIDGEPORT FSS CONTROLS:

1. Madison VORTAC (FSS transmits on 110.4 and receives on 122.1 MHz).

2. Trumbull VOR (FSS transmits on 111.8 and receives on 122.1 MHz).

3. Bridgeport VOR (FSS transmits on 108.8 and receives on 122.1 MHz).

c. BLOCK ISLAND REPORTING SERVICE

Within the Long Island Reporting Service, the New York FSS also provides an additional service for aircraft operating between Montauk Point and Block Island. When requesting this service, pilots should ask for BLOCK ISLAND REPORTING SERVICE and should be prepared to provide the same flight information as required for the Long Island Sound Reporting Service.

(1) A minimum of three position reports are mandatory for this service; these are:

(a) Reporting leaving either Montauk Point or Block Island.

(b) Midway report.

(c) Report when over either Montauk Point or Block Island. At this time, the overwater service is cancelled.

(2) COMMUNICATIONS: Pilots are to transmit on 122.1 MHz and listen on the Hampton VORTAC (HTO) frequency 113.6 MHz.

NOTE.— Pilots are advised that 122.1 MHz is a remote receiver located at the Hampton VORTAC site and designed to provide radio coverage between Hampton and Block Island. Flights proceeding beyond Block Island may contact the Boston FSS on 122.6 MHz (transmit and receive) or by transmitting on 122.1 MHz and listening on Martha's Vineyard VORTAC (MVY) frequency 108.2 MHz.

d. CAPE COD AND ISLANDS RADAR OVERWATER FLIGHT FOLLOWING

In addition to normal VFR radar advisory services, traffic permitting, Otis Approach Control provides a radar overwater flight following service for aircraft traversing the Cape Cod and adjacent Island area. Pilots desiring this service may contact Otis RAPCON on 118.2 MHz.

(1) Pilots requesting this service should be prepared to give the following information:

(a) type and color of aircraft,

(b) altitude,

(c) position and heading,

(d) route of flight, and

(e) true airspeed.

(2) For best radar coverage, pilots are encouraged to fly at 1,500 feet MSL or above.

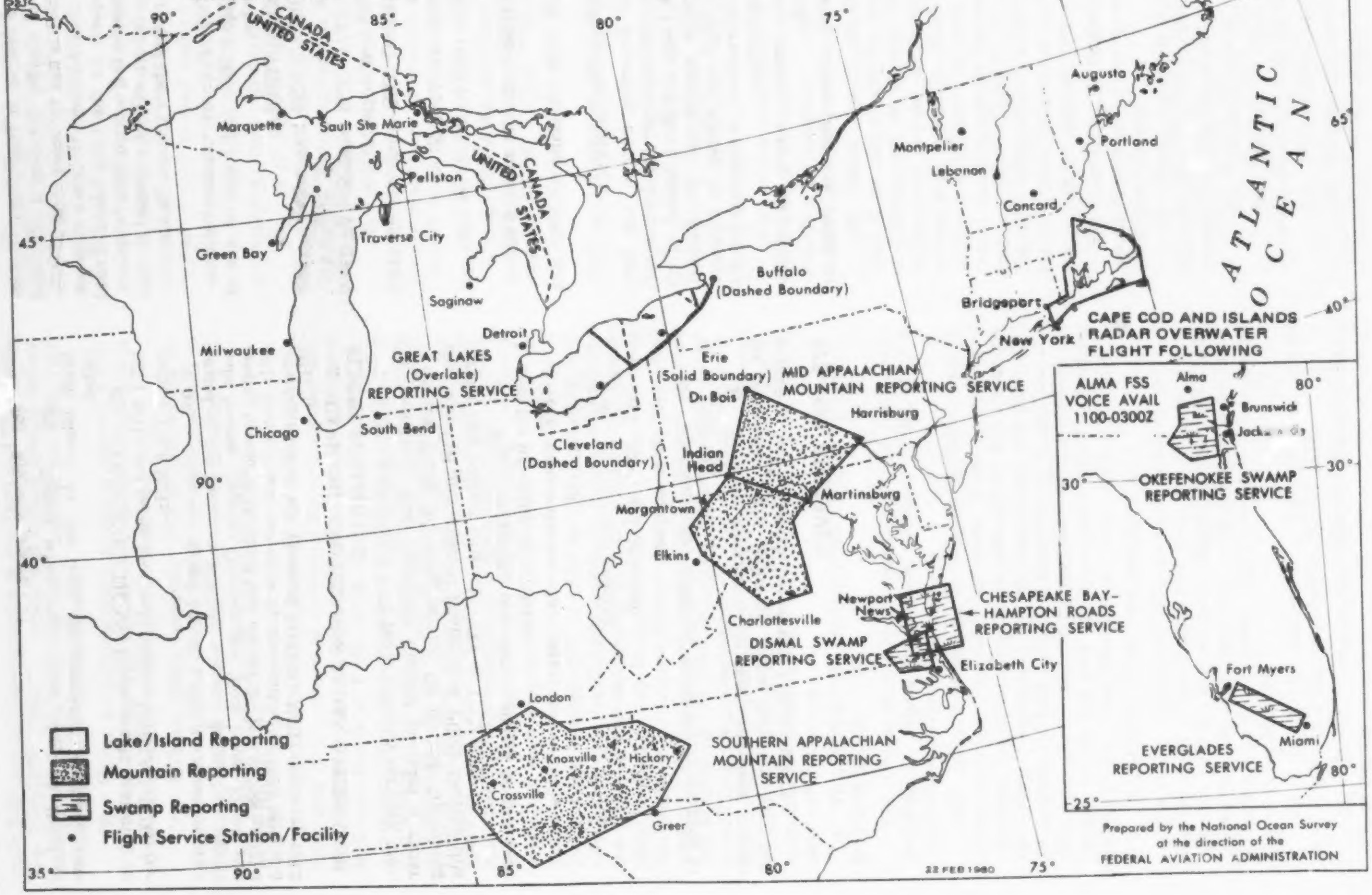
(3) Pilots are responsible for cancelling their request for overwater flight following when they are over the mainland and/or outside the service area boundary.

172—189. RESERVED

LAKE/ISLAND, MOUNTAIN AND SWAMP REPORTING SERVICE

Flight Service Station (FSS)

This service provides flight monitoring where regularly traveled VFR routes cross large bodies of water swamps, and mountains, for the purpose of expeditiously alerting Search and Rescue facilities when required. Areas covered, associated Flight Service Stations, and the name of the service, "Stoneface", "Overlake" etc., are indicated on the following charts. To obtain this service, contact the FSS by telephone or radio giving present position, type aircraft, altitude, indicated air speed, proposed route of flight, and mainland estimate. After these arrangements have been made, a radio contact with the FSS is required every ten minutes while enroute. If contact is lost for more than fifteen minutes, Search and Rescue is alerted.


CANADA
UNITED STATES
90°
85°
80°
75°
70°
45°
40°
35°
65°
30°
25°
Marquette
Sault Ste Marie
Pellston
Traverse City
Green Bay
Saginaw
Milwaukee
Detroit
Chicago
South Bend
GREAT LAKES (Overlake) REPORTING SERVICE
Buffalo (Dashed Boundary)
Erie (Solid Boundary)
Cleveland (Dashed Boundary)
Du Bois
Indian Head
Morgantown
Elkins
Harrisburg
Martinsburg
MID APPALACHIAN MOUNTAIN REPORTING SERVICE
Charlottesville
Newport News
CHESAPEAKE BAY-HAMPTON ROADS REPORTING SERVICE
DISMAL SWAMP REPORTING SERVICE
Elizabeth City
London
Knoxville
Hickory
Crossville
Greer
SOUTHERN APPALACHIAN MOUNTAIN REPORTING SERVICE
Montpelier
Lebanon
Concord
Augusta
Portland
Bridgeport
New York
CAPE COD AND ISLANDS RADAR OVERWATER FLIGHT FOLLOWING
ATLANTIC OCEAN
ALMA FSS VOICE AVAIL 1100-0300Z
Alma
Brunswick
Jacksonville
OKEFENOKEE SWAMP REPORTING SERVICE
Fort Myers
Miami
EVERGLADES REPORTING SERVICE
Lake/Island Reporting
Mountain Reporting
Swamp Reporting
Flight Service Station/Facility
22 FEB 1980

Prepared by the National Ocean Survey at the direction of the FEDERAL AVIATION ADMINISTRATION

Section 2. RADIO COMMUNICATIONS PHRASEOLOGY AND TECHNIQUES

190. GENERAL

a. Radio communications are a critical link in the ATC system. The link can be a strong bond between pilot and controller or it can be broken with surprising speed and disastrous results. Discussion herein provides basic procedures for new pilots and also highlights safe operating concepts for all pilots.

b. The single, most important thought in pilot-controller communications is understanding. It is essential, therefore, that pilots acknowledge each radio communication with ATC by using the appropriate aircraft call sign. Brevity is important, and contacts should be kept as brief as possible, but the controller must know what you want to do before he can properly carry out his control duties. And you, the pilot, must know exactly what he wants you to do. Since concise phraseology may not always be adequate, use whatever words are necessary to get your message across.

c. All pilots will find the Pilot/Controller Glossary very helpful in learning what certain words or phrases mean. Good phraseology enhances safety and is the mark of a professional pilot. Jargon, chatter and "CB" slang have no place in ATC communications. The Pilot/Controller Glossary is the same glossary used in the ATC controller's handbook. We recommend that it be studied and reviewed from time to time to sharpen your communication skills.

d. Calls to air traffic control (ATC) facilities (ARTCCs, Towers, FSSs, Central Flow, and Communications Control Centers) over radio and ATC operational telephone lines (lines used for operational purposes such as controller instructions, briefings, opening and closing flight plans, issuance of IFR clearances and amendments, counter hijacking activities, etc.) may be monitored and recorded for operational uses such as accident investigations, accident prevention, search and rescue purposes, specialist training and evaluation, and technical evaluation and repair of control and communications systems.

191. RADIO TECHNIQUE

a. *Listen* before you transmit. Many times you can get the information you want through ATIS or by monitoring the frequency. Except for a few situations where some frequency overlap occurs, if you hear someone else talking, the keying of your transmitter will be futile and you will probably jam their receivers causing them to repeat their call. If you have just changed frequencies, pause, listen and make sure the frequency is clear.

b. *Think* before keying your transmitter. Know what you want to say and if it is lengthy, e.g., a flight plan or IFR position report, jot it down.

c. The microphone should be very close to your lips and after pressing the mike button, a slight pause may be necessary to be sure the first word is transmitted. Speak in a normal conversational tone.

d. When you release the button, wait a few seconds before calling again. The controller or FSS specialist may be jotting down your number, looking for your flight plan, transmitting on a different frequency, or selecting his transmitter to your frequency.

e. Be alert to the sounds *or lack of sounds* in your receiver. Check your volume, recheck your frequency and *make sure that your microphone is not stuck* in the transmit position. Frequency blockage can, and has, occurred for extended periods of time due to unintentional transmitter operation. This type of interference is commonly referred to as a "stuck mike," and controllers may refer to it in this manner when attempting to assign an alternate frequency. If the assigned frequency is completely blocked by this type of interference, use the procedures described for en route IFR radio frequency outage, to establish or reestablish communications with ATC.

f. Be sure that you are within the performance range of your radio equipment and the ground station equipment. Remote radio sites do not always transmit and receive on all of a facilities available frequencies, particularly with regard to VOR sites where you can hear but not reach a ground station's receiver. Remember that higher altitude increases the range of VHF "line of sight" communications.

192. CONTACT PROCEDURES

a. Initial Contact.

(1) The term initial contact or initial callup means the first radio call you make to a given facility, or the first call to a different controller or FSS specialist within a facility. *Use the following format:*

(a) name of facility being called,

(b) your *full* aircraft identification as filed in the flight plan or as discussed under Aircraft Call Signs below,

(c) type of message to follow or your request if it is short, and

(d) the word "Over."

EXAMPLE:

"NEW YORK RADIO, MOONEY THREE ONE ONE ECHO, OVER."

EXAMPLE:

"COLUMBIA GROUND, CESSNA THREE ONE SIX ZERO FOXTROT, IFR MEMPHIS, OVER."

EXAMPLE:

"MIAMI CENTER BARON FIVE SIX THREE HOTEL, REQUEST VFR TRAFFIC ADVISORIES, OVER."

(2) If radio reception is reasonably assured, inclusion of your request, your position or altitude, the phrase "Have numbers" or "Information Charlie received" (for ATIS) in the initial contact helps decrease radio frequency congestion. Use discretion and do not overload the controller with information he does not need. If you do not get a response from the ground station, recheck your radios or use another transmitter but keep the next contact short.

EXAMPLE:

"ATLANTA CENTER, DUKE FOUR ONE ROMEO, REQUEST VFR TRAFFIC ADVISORIES, TWENTY NORTHWEST ROME, SEVEN THOUSAND FIVE HUNDRED, OVER."

b. Initial Contact When your Transmitting and Receiving Frequencies are Different.

(1) If you are attempting to establish contact with a ground station and you are receiving on a different frequency than that transmitted, indicate the VOR name or the frequency on which you expect a reply. Most FSSs and control facilities can transmit on several VOR stations in the area. Use the appropriate FSS call sign as indicated on charts.

EXAMPLE:

New York FSS transmits on the Kennedy, Hampton and Calverton VORTACs. If you are in the Calverton area, your callup should be "NEW YORK RADIO, CESSNA THREE ONE SIX ZERO FOXTROT, RECEIVING CALVERTON VOR, OVER."

(2) If the chart indicates FSS frequencies above the VORTAC or in FSS communications boxes, transmit or receive on those frequencies nearest your location.

(3) When unable to establish contact and you wish to call *any* ground station, use the phrase "ANY RADIO (tower) (station), GIVE CESSNA THREE ONE SIX ZERO FOXTROT A CALL ON (frequency) OR (VOR)." If an emergency exists or you need assistance, so state.

c. Subsequent Contacts and Responses to Callup from a Ground Facility.

Use the same format as used for initial contact except you should state your message or request with the callup in one transmission. The ground station name and the word "Over" may be omitted if the message requires an obvious reply and there is no possibility for misunderstandings. *You should acknowledge all callups or clearances* unless the controller or FSS specialist advises otherwise. There are some occasions when the controller must issue time-critical instructions to other aircraft and he may be in a position to observe your response, either visually or on radar. If the situation demands your response, take appropriate action or immediately advise the facility of any problem. Acknowledgement is made with one of the words "Wilco, Roger, Affirmative, Negative" or other appropriate remarks (e.g., "PIPER TWO ONE FOUR LIMA, ROGER"). If you have been receiving services (e.g., VFR traffic advisories and you are leaving the area or changing frequencies), advise the ATC facility and terminate contact.

d. Acknowledgement of Frequency Changes.

(1) When advised by ATC to change frequencies, acknowledge the instruction. If you select the new frequency without an acknowledgement, the controller's workload is increased because he has no way of knowing whether you received the instruction or have had radio communications failure.

(2) At times, a controller/specialist may be working a sector with multiple frequency assignments. In order to eliminate unnecessary verbiage and to free the controller/specialist for higher priority transmissions, the controller/specialist may request the pilot "(Identification), change to my frequency 123.4." This phrase should alert the pilot that he is only changing frequencies, not controller/specialist, and that initial call up phraseology may be abbrevi ed.

EXAMPLE:

"UNITED 222 ON 123.4."

e. Compliance with Frequency Changes.

When instructed by ATC to change frequencies, sel the new frequency as soon as possible unless instructed make the change at a specific time, fix, or altitude. A del in making the change could result in an untimely recei of important information. If you are instructed to make th frequency change at a specific time, fix, or altitude, mon tor the frequency you are on until reaching the specifi time, fix, or altitudes unless instructed otherwise by AT (See PARA—340 - ARTCC COMMUNICATIONS.)

193. AIRCRAFT CALL SIGNS

a. Precautions in the Use of Call Signs.

(1) Improper use of call signs can result in pilots ex cuting a clearance intended for another aircraft. Call sig should *never be abbreviated on an initial contact or at an time when other aircraft call signs have similar number sounds or identical letters/number* (e.g., Cessna 61 Cessna 1622F, Baron 123F, Cherokee 7732F, etc.).

EXAMPLE:

Assume that a controller issues an approach clearan to an aircraft at the bottom of a holding stack and aircraft with a similar call sign (at the top of the stac acknowledges the clearance with the last two or thr numbers of his call sign. If the aircraft at the botto of the stack did not hear the clearance and interve flight safety would be affected, and there would be n reason for either the controller or pilot to suspect th anything is wrong. This kind of "human factors" er can strike swiftly and is extremely difficult to rectif

(2) Pilots; therefore, must be certain that aircra identification is complete and clearly identified befo taking action on an ATC clearance. ATC specialists wi not abbreviate call signs of air carrier or other civil a craft having authorized call signs. ATC specialists may in tiate abbreviated call signs of other aircraft by using th *prefix and the last three digits/letters* of the aircraft ide tification after communications are established. The pi may use the abbreviated call sign in subsequent contac with the ATC specialist. When aware of similar/identic call signs, ATC specialists will take action to minimi errors by emphasizing certain numbers/letters, by repe ing the entire call sign, repeating the prefix, or by askin pilots to use a different call sign temporarily. Pilots shou use the phrase "VERIFY CLEARANCE FOR (your co plete call sign)" if doubt exists concerning proper identi

(3) Civil aircraft pilots should state the aircraft typ model or manufacturer's name followed by the digits/le ters of the registration number. When the aircraft man facturer's name or model is stated, the prefix "N" dropped (e.g. Aztec Two Four Six Four Alpha).

EXAMPLE:

BONANZA SIX FIVE FIVE GOLF.

EXAMPLE:

BREEZY SIX ONE THREE ROMEO EXPERIME TAL (omit "Experimental" after initial contact).

(4) Air Taxi or other commercial operators *not* having FAA authorized call signs should prefix their normal identification with the phonetic word "Tango".

EXAMPLE:

TANGO AZTEC TWO FOUR SIX FOUR ALPHA.

(5) Air carriers and commuter air carriers having FAA authorized call signs should identify themselves by stating the complete call sign, using group form for the numbers and the word "heavy" if appropriate.

EXAMPLE:

UNITED TWENTY-FIVE HEAVY.

EXAMPLE:

MIDWEST COMMUTER SEVEN ELEVEN.

(6) Military aircraft use a variety of systems including serial numbers, word call signs and combinations of letters/numbers. Examples include Army Copter 48931, Air Force 61782, MAC 31792, Pat 157, Air Evac 17652, Navy Golf Alfa Kilo 21, Marine 4 Charlie 36, etc.

b. Air Ambulance Flights.

(1) Civilian air ambulance flights responding to medical emergencies (carrying patients, organ donors, organs, or other urgently needed lifesaving medical material) will be expedited by ATC when necessary. When expeditious handling is required, add the word "LIFEGUARD" in the remarks of the flight plan. In radio communication, use the call sign "LIFEGUARD" followed by the aircraft type and registration letters/numbers. When requested by the pilot, necessary notification to expedite ground handling of patients, etc., is provided by ATC; however, when possible, this information should be passed in advance through non-ATC communications systems. Extreme discretion is necessary in using the term "LIFEGUARD." It is intended only for those missions of an urgent medical nature and for use only for that portion of the flight requiring expedited handling.

(2) Similar provisions have been made for the use of "AIR EVAC" and "MED EVAC" by military air ambulance flights, except that these military flights will receive priority handling only when specifically requested.

EXAMPLE:

LIFEGUARD CESSNA TWO SIX FOUR SIX.

c. Student Pilots Radio Identification.

(1) The FAA desires to help the student pilot in acquiring sufficient practical experience in the environment in which he will be required to operate. To receive additional assistance while operating in areas of concentrated air traffic, a student pilot need only identify himself as a student pilot during his initial call to an FAA radio facility.

EXAMPLE:

DAYTON TOWER, THIS IS FLEETWING 1234, STUDENT PILOT, OVER.

(2) This special identification will alert FAA ATC personnel and enable them to provide the student pilot with such extra assistance and consideration as he may need. This procedure is not mandatory.

194. DESCRIPTION OF INTERCHANGE OR LEASED AIRCRAFT

a. Controllers issue traffic information based on familiarity with airline equipment and color/markings. When an air carrier dispatches a flight using another company's equipment and the pilot does not advise the terminal ATC facility, the possible confusion in aircraft identification can compromise safety.

b. Pilots flying an "interchange" or "leased" aircraft not bearing the colors/markings of the company operating the aircraft should inform the terminal ATC facility on first contact the name of the operating company and trip number, followed by the company name as displayed on the aircraft, and aircraft type.

EXAMPLE:

AIR CAL 311, UNITED (INTERCHANGE/LEASE), BOEING 727.

195. GROUND STATION CALL SIGNS

Pilots, when calling a ground station, should begin with the name of the facility being called followed by the type of the facility being called, as indicated in the following examples.

Airport Unicom	"Shannon Unicom"
FAA Flight Service Station	"Chicago Radio"
FAA Flight Service Station (En Route Flight Advisory Service (Weather)	"Seattle Flight Watch"
Airport Traffic Control Tower	"Augusta Tower"
Clearance Delivery Position (IFR)	"Dallas Clearance Delivery"
Ground Control Position in Tower	"Miami Ground"
Radar or Nonradar Approach Control Position	"Oklahoma City Approach"
Radar Departure Control Position	"St. Louis Departure"
FAA Air Route Traffic Control Center	"Washington Center"

196. PHONETIC ALPHABET

The International Civil Aviation Organization (ICAO) phonetic alphabet is used by FAA personnel when communications conditions are such that the information cannot be readily received without their use. ATC facilities may also request pilots to use phonetic letter equivalents when aircraft with similar sounding identifications are receiving communications on the same frequency. Pilots should use the phonetic alphabet when identifying their aircraft during initial contact with air traffic control facilities. Additionally use the phonetic equivalents for single letters and to spell out groups of letters or difficult words during adverse communications conditions.

CHARACTER	MORSE CODE	TELEPHONY	PHONIC (PRONUNCIATION)
A	○▭	Alfa	(AL-FAH)
B	▭○○○	Bravo	(BRAH-VOH)
C	▭○▭○	Charlie	(CHAR-LEE) or (SHAR-LEE)
D	▭○○	Delta	(DELL-TAH)
E	○	Echo	(ECK-OH)
F	○○▭○	Foxtrot	(FOKS-TROT)
G	▭▭○	Golf	(GOLF)
H	○○○○	Hotel	(HOH-TEL)
I	○○	India	IN-DEE-AH)
J	○▭▭▭	Juliett	(JEW-LEE-ETT)
K	▭○▭	Kilo	(KEY-LOH)
L	○▭○○	Lima	(LEE-MAH)
M	▭▭	Mike	(MIKE)
N	▭○	November	(NO-VEM-BER)
O	▭▭▭	Oscar	(OSS-CAH)
P	○▭▭○	Papa	(PAH-PAH)
Q	▭▭○▭	Quebec	(KEH-BECK)
R	○▭○	Romeo	(ROW-ME-OH)
S	○○○	Sierra	(SEE-AIR-RAH)
T	▭	Tango	(TANG-GO)
U	○○▭	Uniform	(YOU-NEE-FORM) or (OO-NEE-FORM)
V	○○○▭	Victor	(VIK-TAH)
W	○▭▭	Whiskey	(WISS-KEY)
X	▭○○▭	Xray	(ECKS-RAY)
Y	▭○▭▭	Yankee	(YANG-KEY)
Z	▭▭○○	Zulu	(ZOO-LOO)
1	○▭▭▭▭	One	(WUN)
2	○○▭▭▭	Two	(TOO)
3	○○○▭▭	Three	(TREE)
4	○○○○▭	Four	(FOW-ER)
5	○○○○○	Five	(FIFE)
6	▭○○○○	Six	(SIX)
7	▭▭○○○	Seven	(SEV-EN)
8	▭▭▭○○	Eight	(AIT)
9	▭▭▭▭○	Nine	(NIN-ER)
0	▭▭▭▭▭	Zero	(ZEE-RO)

197—199. RESERVED

200. FIGURES

a. Figures indicating hundred and thousands in round number, as for ceiling heights, and upper wind levels up to 9900 shall be spoken in accordance with the following:

EXAMPLE:

500..FIVE HUNDRED

EXAMPLE:

4500.................FOUR THOUSAND FIVE HUNDRED

b. Numbers above 9900 shall be spoken by separating the digits preceding the word "thousand."

EXAMPLE:

10,000....................................ONE ZERO THOUSAND

EXAMPLE:

13,500...ONE THREE THOUSAND FIVE HUNDRED

c. Transmit airway or jet route numbers as follows:

EXAMPLE:

V12...VICTOR TWELVE

EXAMPLE:

J533..J FIVE THIRTY-THREE

d. All other numbers shall be transmitted by pronou ing each digit.

EXAMPLE:

10..ONE ZER

e. When a radio frequency contains a decimal point, th decimal point is spoken as "POINT."

EXAMPLE:

122.1...............................ONE TWO TWO POINT ON

NOTE.— ICAO Procedures require the decimal point be spok as "DECIMAL" and FAA will honor such usage by military ai craft and all other aircraft required to use ICAO Procedures.

201. ALTITUDES AND FLIGHT LEVELS

a. Up to but not including 18,000 feet MSL — state th separate digits of the thousands, plus the hundreds, if a propriate.

EXAMPLE:

12,000..ONE TWO THOUSAN

EXAMPLE:

12,500.......ONE TWO THOUSAND FIVE HUNDRE

b. At and above, 18,000 feet MSL (FL 180) state th words "flight level" followed by the separate digits of th flight level.

EXAMPLE:
190.......................FLIGHT LEVEL ONE NINER ZERO

202. DIRECTIONS

The three digits of bearing, course, heading or wind direction should always be magnetic. The word "true" must be added when it applies.

EXAMPLE:
(magnetic course) 005.......................ZERO ZERO FIVE

EXAMPLE:
(true course) 050...................ZERO FIVE ZERO TRUE

EXAMPLE:
(magnetic bearing) 360.....................THREE SIX ZERO

EXAMPLE:
(magnetic heading) 100.....................ONE ZERO ZERO

EXAMPLE:
(wind direction) 220............................TWO TWO ZERO

203. SPEEDS

The separate digits of the speed followed by the word "KNOTS." Except, controllers may omit the word "KNOTS" when using speed adjustment procedures, e.g., "REDUCE/INCREASE SPEED TO TWO FIVE ZERO."

EXAMPLES:
(speed) 250........................TWO FIVE ZERO KNOTS
(speed) 190.........................ONE NINER ZERO KNOTS

The separate digits of the mach number preceded by "MACH."

EXAMPLES:
(mach number) 1.5.............MACH ONE POINT FIVE
(mach number) .64...............MACH POINT SIX FOUR
(mach number) .7......................MACH POINT SEVEN

204. TIME

a. FAA uses Coordinated Universal Time (UTC or Z) for all operations.

b. To Convert from Standard Time to Coordinated Universal Time:

Eastern Standard Time	Add 5 hours
Central Standard Time	Add 6 hours
Mountain Standard Time	Add 7 hours
Pacific Standard Time	Add 8 hours

NOTE.— For Daylight Time subtract 1 hour.

c. The 24-hour clock system is used in radiotelephone transmissions. The hour is indicated by the first two figures and the minutes by the last two figures.

EXAMPLE:
0000...ZERO ZERO ZERO ZERO

EXAMPLE:
0920....................................... ZERO NINER TWO ZERO

d. Time may be stated in minutes only (two figures) in radio telephone communications when no misunderstanding is likely to occur.

e. Current time in use at a station is stated in the nearest quarter minute in order that pilots may use this information for time checks. Fractions of a quarter minute less than eight seconds are stated as the preceding quarter minute; fractions of a quarter minute of eight seconds or more are stated as the succeeding quarter minute.

EXAMPLE:
0929:05..................TIME, ZERO NINER TWO NINER

EXAMPLE:
0929:10...TIME, ZERO NINER TWO NINER AND ONE-QUARTER

205. COMMUNICATIONS WITH TOWER WHEN AIRCRAFT TRANSMITTER OR RECEIVER OR BOTH ARE INOPERATIVE

a. Arriving Aircraft

(1) Receiver inoperative — If you have reason to believe your receiver is inoperative, remain outside or above the airport traffic area until the direction and flow of traffic has been determined, then advise the tower of your type aircraft, position, altitude, intention to land and request that you be controlled with light signals. (See PARA—233 - TRAFFIC CONTROL OF LIGHT SIGNALS.) When you are approximately 3 to 5 miles from the airport, advise the tower of your position and join the airport traffic pattern. From this point on, watch the tower for light signals. Thereafter, if a complete pattern is made, transmit your position downwind and/or turning base leg.

(2) Transmitter inoperative — Remain outside or above the airport traffic area until the direction and flow of traffic has been determined, then join the airport traffic pattern. Monitor the primary local control frequency as depicted on Sectional Charts for landing or traffic information, and look for a light signal which may be addressed to your aircraft. During hours of daylight, acknowledge tower transmissions or light signals by rocking your wings. At night, acknowledge by blinking the landing or navigation lights. To acknowledge tower transmissions during daylight hours, hovering helicopters will turn in the direction of the controlling facility and flash the landing light. While in flight, helicopters should show their acknowledgement of receiving a transmission by making shallow banks in opposite directions. At night, helicopters will acknowledge receipt of transmissions by flashing either the landing or the search light.

(3) Transmitter and receiver inoperative — Remain outside or above the airport traffic area until the direction and flow of traffic has been determined, then join the airport traffic pattern and maintain visual contact with the tower to receive light signals. Acknowledge light signals as noted above.

b. Departing Aircraft

(1) If you experience radio failure prior to leaving the parking area, make every effort to have the equipment repaired. If you are unable to have the malfunction repaired, call the tower by telephone and request authorization to depart without two-way radio communications. If tower authorization is granted, you will be given departure information and requested to monitor the tower frequency or watch for light signals, as appropriate. During daylight hours, acknowledge tower transmissions or light signals by moving the ailerons or rudder. At night, acknowledge by blinking the landing or navigation lights. If radio malfunction occurs after departing the parking area, watch the tower for light signals or monitor tower frequency.

NOTE.— Refer to FAR—91.87 and FAR—91.77.

206. COMMUNICATIONS FOR VFR FLIGHTS

a. FSSs are allocated frequencies for different functions, for Airport Advisory Service the pilot should contact the FSS on 123.6 MHz, for example. Other FSS frequencies are listed with the FSS in the Airport/Facility Directory. If you are in doubt as to what frequency to use to contact FSS, transmit on 122.1 MHz and advise them of the quency you are receiving on.

b. On VFR flights, guard the voice channel of VORs broadcasts and calls from FAA FSSs. Where the VOR channel is being utilized for ATIS broadcasts, pilots of flights are urged to guard the voice channel of an adjac VOR. When in contact with a control facility, notify controller if you plan to leave the frequency.

207—219. RESERVED

Section 3. AIRPORT OPERATIONS

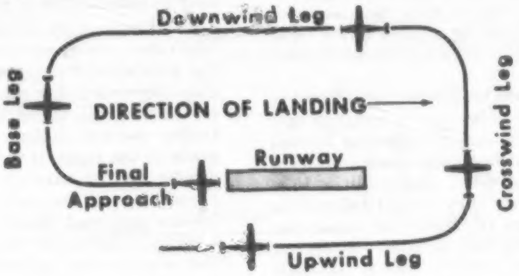
220. GENERAL

Increased traffic congestion, aircraft in climb and descent attitudes, and pilots preoccupation with cockpit duties are some factors that increase the hazardous accident potential near the airport. The situation is further compounded when the weather is marginal — that is, just meeting VFR requirements. Pilots must be particularly alert when operating in the vicinity of an airport. This section defines some rules, practices and procedures that pilots should be familiar with, and adhere to, for safe airport operations.

221. TOWER CONTROLLED AIRPORTS

a. When operating at an airport where traffic control is being exercised by a control tower, pilots are required to maintain two-way radio contact with the tower while operating within the airport traffic area unless the tower authorizes otherwise. Initial call-up should be made about 15 miles from the airport. Unless there is a good reason to leave the tower frequency before exiting the airport traffic area it is a good operating practice to remain on the tower frequency for the purpose of receiving traffic information. In the interest of reducing tower frequency congestion, pilots are reminded that it is not necessary to request permission to leave the tower frequency once outside of the airport traffic area.

b. When necessary, the tower controller will issue clearances or other information for aircraft to generally follow the desired flight path (traffic patterns) when flying in the airport traffic area/control zone, and the proper taxi routes when operating on the ground. If not otherwise authorized or directed by the tower, pilots of fixed-wing aircraft approaching to land must circle the airport to the left. Pilots approaching to land in a helicopter must avoid the flow of fixed-wing traffic. However, in all instances, an appropriate clearance must be received from the tower before landing.



NOTE.— This diagram is intended only to illustrate terminology used in identifying various components of a traffic pattern. It should not be used as a reference or guide on how to enter a traffic pattern.

c. The following terminology for the various components of a traffic pattern has been adopted as standard for use by control towers and pilots:

(1) Upwind leg — A flight path parallel to the landing runway in the direction of landing.

(2) Crosswind leg — A flight path at right angles to the landing runway off its takeoff end.

(3) Downwind leg — A flight path parallel to the landing runway in the opposite direction of landing.

(4) Base leg — A flight path at right angles to the landing runway off its approach end and extending from the downwind leg to the intersection of the extended runway centerline.

(5) Final approach — A flight path in the direction of landing along the extended runway centerline from the base leg to the runway.

d. Many towers are equipped with a tower radar display. The radar uses are intended to enhance the effectiveness and efficiency of the local control, or tower, position. They are not intended to provide radar services or benefits to pilots except as they may accrue through a more efficient tower operation. The four basic uses are:

(1) To determine an aircraft's exact location —This is accomplished by radar identifying the VFR aircraft through any of the techniques available to a radar position; such as having the aircraft ident. Once identified, the aircraft's position and spatial relationship to other aircraft can be quickly determined and standard instructions regarding VFR operation in the airport traffic area will be issued. Once initial radar identification of a VFR aircraft has been established and the appropriate instructions have been issued, radar monitoring may be discontinued. The reason being that the local controller's primary means of surveillance in VFR conditions is visually scanning the airport and local area.

(2) To provide radar traffic advisories —Radar traffic advisories may be provided to the extent that the local controller is able to monitor the radar display. Local control has primary control responsibilities to the aircraft operating on the runways which will normally supercede radar monitoring duties.

(3) To provide a direction or suggested heading — The local controller may provide pilots flying VFR with generalized instructions which will facilitate operations (e.g.,"PROCEED SOUTHWEST BOUND, ENTER A RIGHT DOWNWIND RUNWAY THREE ZERO"); or provide a suggested heading to establish radar identification or as an advisory aid to navigation (e.g., "SUGGESTED HEADING TWO TWO ZERO, FOR RADAR IDENTIFICATION"). In both cases, the instructions are advisory aids to the pilot flying VFR and are not radar vectors. PILOTS HAVE COMPLETE DISCRETION REGARDING ACCEPTANCE OF THE SUGGESTED HEADING OR DIRECTION AND HAVE SOLE RESPONSIBILITY FOR SEEING AND AVOIDING OTHER AIRCRAFT.

(4) To provide information and instructions to aircraft operating within the airport traffic area —In an example of this situation, the local controller would use the radar to advise a pilot on an extended downwind when to turn base leg.

NOTE.— The above tower radar applications are intended to augment the standard functions of the local control position. There is no controller requirement to maintain constant radar identification and, in fact, such a requirement could compromise the local controllers ability to visually scan the airport and local area to meet FAA responsibilities to the aircraft operating on the runways and within the airport traffic area. Normally, pilots will not be advised of being in radar contact since that continued status cannot be guaranteed and since the purpose of the radar identification is not to establish a link for the provision of radar services.

e. A few of the radar equipped towers are authorized to use the radar to ensure separation between aircraft in specific situations, while still others may function as limited radar approach controls. The various radar uses are strictly a function of FAA operational need. The facilities may be indistinguishable to pilots since they are all referred to as tower and no publication lists the degree of radar use. Therefore, WHEN IN COMMUNICATION WITH A TOWER CONTROLLER WHO MAY HAVE RADAR AVAILABLE, DO NOT ASSUME THAT CONSTANT RADAR MONITORING AND COMPLETE ATC RADAR SERVICES ARE BEING PROVIDED.

222. VISUAL INDICATORS AT UNCONTROLLED AIRPORTS

a. At those airports *without an operating control tower,* a segmented circle visual indicator system, if installed, is designed to provide traffic pattern information. (See PARA—157 - TRAFFIC ADVISORY PRACTICES AT AIRPORTS WHERE A TOWER IS NOT IN OPERATION). The segmented circle system consists of the following components:

(1) The segmented circle — Located in a position affording maximum visibility to pilots in the air and on the ground and providing a centralized location for other elements of the system.

(2) The Wind Direction Indicator — A wind cone, wind sock, or wind tee installed near the operational runway to indicate wind direction. The large end of the wind cone/wind sock points into the wind as does the large end (cross bar) of the wind tee. In lieu of a tetrahedron and where a wind sock or wind cone is collocated with a wind tee, the wind tee may be manually aligned with the runway in use to indicate landing direction. These signaling devices may be located in the center of the segmented circle and may be lighted for night use. Pilots are cautioned against using a tetrahedron to indicate wind direction.

(3) The Landing Direction Indicator — A tetrahedron is installed when conditions at the airport warrant its use. It may be used to indicate the direction of landings and takeoffs. A tetrahedron may be located at the center of a segmented circle and may be lighted for night operations. The small end of the tetrahedron points in the direction of landing. Pilots are cautioned against using a tetrahedron for any purpose other than as an indicator of landing direction, and to disregard the tetrahedron at an airport with an operating tower. Tower instructions supersede tetrahedron indications.

(4) Landing strip indicators — Installed in pairs shown in the segmented circle diagram and used to sho the alignment of landing strips.

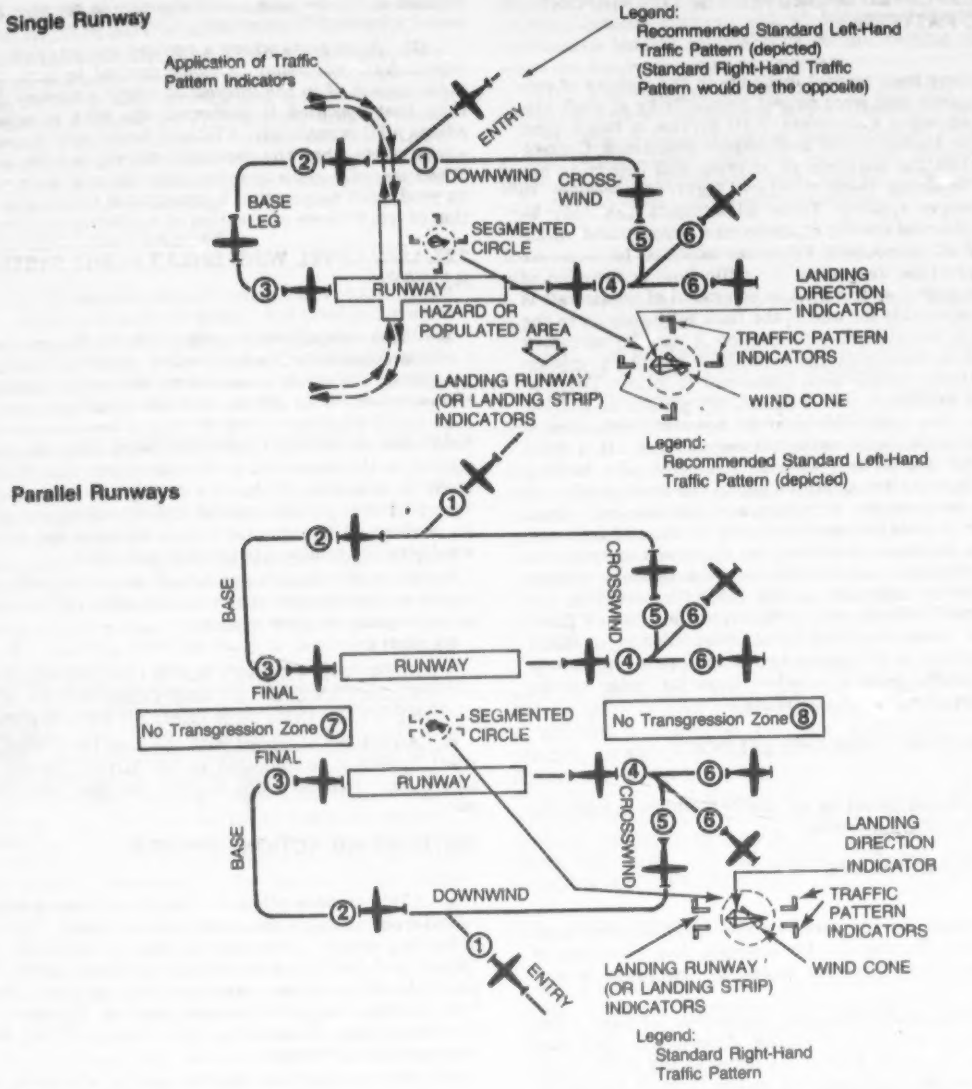
(5) Traffic pattern indicators — Arranged in pai in conjunction with landing strip indicators and used to i dicate the direction of turns when there is a variation fro the normal left traffic pattern. (If there is no segmente circle installed at the airport, traffic pattern indicato may be installed on or near the end of the runway.)

b. Preparatory to landing at an airport without a co trol tower, or when the control tower is not in operatio the pilot should concern himself with the indicator for t approach end of the runway to be used. When approachi for landing, all turns must be made to the left unless traffic pattern indicator indicates that turns should made to the right. If the pilot will mentally enlarge the dicator for the runway to be used, the base and final proach legs of the traffic pattern to be flown immediat become apparent. Similar treatment of the indicator at departure end of the runway will clearly indicate the dir tion of turn after takeoff.

c. When two or more aircraft are approaching an port for the purpose of landing, the aircraft at the lo altitude has the right of way, but it shall not take adv tage of this rule to cut in front of another which is on fi approach to land, or to overtake that aircraft (FA 91.67(f)).

223. TRAFFIC PATTERNS

At most airports and military air bases, traffic patt altitudes for propeller driven aircraft generally ext from 600 feet to as high as 1,500 feet above the grou Also, traffic pattern altitudes for military turbojet airc sometimes extend up to 2,500 feet above the ground. Th fore, pilots of en route aircraft should be constantly on alert for other aircraft in traffic patterns and avoid t areas whenever possible. Traffic pattern altitudes sh be maintained unless otherwise required by the applic distance from cloud criteria (FAR—91.105).


Single Runway
Application of Traffic Pattern Indicators
ENTRY
①
②
DOWNWIND
CROSS-WIND
BASE LEG
SEGMENTED CIRCLE
⑤
⑥
③
RUNWAY
④
⑥
LANDING DIRECTION INDICATOR
HAZARD OR POPULATED AREA
TRAFFIC PATTERN INDICATORS
LANDING RUNWAY (OR LANDING STRIP) INDICATORS
WIND CONE
Parallel Runways
①
②
CROSSWIND
BASE
⑤
⑥
③
RUNWAY
④
⑥
FINAL
No Transgression Zone ⑦
SEGMENTED CIRCLE
No Transgression Zone ⑧
FINAL
③
RUNWAY
④
⑥
CROSSWIND
⑤
⑥
BASE
LANDING DIRECTION INDICATOR
②
DOWNWIND
TRAFFIC PATTERN INDICATORS
①
ENTRY
LANDING RUNWAY (OR LANDING STRIP) INDICATORS
WIND CONE

Legend:
Recommended Standard Left-Hand Traffic Pattern (depicted)
(Standard Right-Hand Traffic Pattern would be the opposite)

Legend:
Recommended Standard Left-Hand Traffic Pattern (depicted)

Legend:
Standard Right-Hand Traffic Pattern

Key:

① Enter pattern in level flight, abeam the midpoint of the runway, at pattern altitude. (1000' AGL is recommended pattern altitude unless established otherwise).

② Maintain pattern altitude until abeam approach end of the landing runway, or downwind leg.

③ Complete turn to final at least ¼ mile from the runway.

④ Continue straight ahead until beyond departure end of runway.

⑤ If remaining in the traffic pattern, commence turn to crosswind leg beyond the departure end of the runway, within 300 feet of pattern altitude.

⑥ If departing the traffic pattern, continue straight out, or exit with a 45° left turn beyond the departure end of the runway, after reaching pattern altitude.

⑦ Do not overshoot final or continue on a track which will penetrate the final approach of the parallel runway.

⑧ Do not continue on a track which will penetrate the departure path of the parallel runway.

224. UNEXPECTED MANEUVERS IN THE AIRPORT TRAFFIC PATTERN

There have been several incidents in the vicinity of controlled airports that were caused primarily by aircraft executing unexpected maneuvers. ATC service is based upon observed or known traffic and airport conditions. Controllers establish the sequence of arriving and departing aircraft by requiring them to adjust flight as necessary to achieve proper spacing. These adjustments can only be based on observed traffic, accurate pilot reports, and anticipated aircraft maneuvers. Pilots are expected to cooperate so as to preclude disruption of traffic flow or creation of conflicting patterns. The pilot in command of an aircraft is directly responsible for and is the final authority as to the operation of his aircraft. On occasion it may be necessary for a pilot to maneuver his aircraft to maintain spacing with the traffic he has been sequenced to follow. The controller can anticipate minor maneuvering such as shallow "S" turns. The controller cannot, however, anticipate a major maneuver such as a 360 degree turn. If a pilot makes a 360 degree turn after he has obtained a landing sequence, the result is usually a gap in the landing interval and more importantly it causes a chain reaction which may result in a conflict with following traffic and interruption of the sequence established by the tower or approach controller. Should a pilot decide he needs to make maneuvering turns to maintain spacing behind a preceding aircraft, he should always advise the controller if at all possible. Except when requested by the controller or in emergency situations, a 360 degree turn should never be executed in the traffic pattern or when receiving radar service without first advising the controller.

225. WIND DIRECTION AND VELOCITY

Wind direction issued by air traffic facilities is magnetic and wind velocity is in knots.

226. USE OF RUNWAYS

a. Runways are numbered to correspond to their magnetic bearing. Runway 27, for example, has a bearing of 270 degrees. Wind direction issued by the tower is also magnetic.

b. Airport proprietors are responsible for taking the lead in local aviation noise control. Accordingly, they may propose specific noise abatement plans to the FAA. If approved, these plans are applied in the form of Formal or Informal Runway Use Programs (see Glossary) for noise abatement purposes.

(1) At airports where no runway use program is established, ATC clearances may specify:

(a) the runway most nearly aligned with the wind when it is 5 knots or more,

(b) the "calm wind" runway when wind is less than 5 knots, or

(c) another runway if operationally advantageous.

NOTE.— It is not necessary for a controller to specifically inquire if the pilot will use a specific runway or to offer him a choice of runways. If a pilot prefers to use a different runway than that specified or the one most nearly aligned with the wind, he is expected to inform ATC accordingly.

(2) At airports where a runway use program is established, ATC will assign runways deemed to have the least noise impact. If in the interest of safety a runway different than that specified is preferred, the pilot is expected to advise ATC accordingly. ATC will honor such requests and advise pilots when the requested runway is noise sensitive. When use of a runway other than the one assigned is requested, pilot cooperation is encouraged to preclude disruption of traffic flows or creation of conflicting patterns.

227. LOW LEVEL WIND SHEAR ALERT SYSTEM (LLWAS)

a. This computerized system detects the presence of a possible hazardous low-level wind shear by continuously comparing the winds measured by sensors installed around the periphery of an airport with the wind measured at the centerfield location. If the difference between the centerfield wind sensor and a peripheral wind sensor becomes excessive, a thunderstorm or thunderstorm gust front wind shear is probable. When this condition exists, the tower controller will provide arrival and departure aircraft with an advisory of the situation which includes the centerfield wind plus the remote site location and wind.

b. Since the sensors are not all associated with specific runways, descriptions of the remote sites will be based on an eight point compass system.

EXAMPLE:

DELTA ONE TWENTY FOUR CENTERFIELD WIND TWO SEVEN ZERO AT ONE ZERO. SOUTH BOUNDARY WIND ONE FOUR ZERO AT THREE ZERO.

c. An airport equipped with the Low Level Wind Shear Alert System is so indicated in the Airport/Facility Directory under *Weather Data Sources* for that particular airport.

228. BRAKING ACTION REPORTS

a. ATC furnishes pilots the quality of braking action received from pilots or the airport management. The quality of braking action is described by the terms "good," "fair," "poor," and "nil" or a combination of these terms. When available from airport management numerical readings from friction measuring devices, such as Mu-Meter, Saab Friction Tester, Skidometer, and Tapley Meter will be issued at pilot's request.

b. Pilots should describe the quality of braking action by using the terms noted above. In describing braking action for a portion of a runway, pilots should use descriptive terms that are easily understood, such as, "braking action poor the first/last half of the runway." Reports reference to local landmarks, buildings, etc., should be avoided.

229. BRAKING ACTION ADVISORIES

a. When tower controllers have received runway braking action reports which include the terms *poor* or *nil*, or whenever weather conditions are conducive to deteriorating or rapidly changing runway braking conditions, the

pages tightly bound

tower will include on the ATIS broadcast the statement, "*BRAKING ACTION ADVISORIES ARE IN EFFECT.*"

b. During the time that Braking Action Advisories are in effect, ATC will issue the latest braking action report for the runway in use to each arriving and departing aircraft. Pilots should be prepared for deteriorating braking conditions and should request current runway condition information if not volunteered by controllers. Pilots should also be prepared to provide a descriptive runway condition report to controllers after landing.

230. INTERSECTION TAKEOFFS

a. In order to enhance airport capacities, reduce taxiing distances, minimize departure delays, and provide for more efficient movement of air traffic, controllers may initiate intersection takeoffs as well as approve them when the pilot requests. If for ANY reason a pilot prefers to use a different intersection or the full length of the runway or desires to obtain the distance between the intersection and the runway end, HE IS EXPECTED TO INFORM ATC ACCORDINGLY.

b. An aircraft is expected to taxi to (but not onto) the end of the assigned runway unless prior approval for an intersection departure is received from ground control.

c. Controllers are required to separate small aircraft (12,500 pounds or less, maximum certificated takeoff weight) departing (same or opposite direction) from an intersection behind a large nonheavy aircraft on the same runway, by ensuring that at least a 3-minute interval exists between the time the preceding large aircraft has taken off and the succeeding small aircraft begins takeoff roll. To inform the pilot of the required 3-minute hold, the controller will state, "Hold for wake turbulence." If after considering wake turbulence hazards, the pilot feels that a lesser time interval is appropriate, he may request a waiver to the 3-minute interval. Pilots must initiate such a request by stating, "Request waiver to 3-minute interval," or by making a similar statement. Controllers may then issue a takeoff clearance if other traffic permits, since the pilot has accepted responsibility for his own wake turbulence separation.

d. The 3-minute interval will not be applied when the intersection is 500 feet or less from the threshold and both aircraft are taking off in the same direction. When a small aircraft is departing from an intersection 500 feet or less from the runway threshold behind a large nonheavy aircraft and both aircraft are taking off in the same direction, the 3-minute interval will not be applied. Controllers will issue a clearance to permit the small aircraft to alter course to avoid the flight path of the preceding departure.

e. The 3-minute interval is mandatory behind a heavy aircraft in all cases.

231. SIMULTANEOUS OPERATIONS ON INTERSECTING RUNWAYS

a. Despite the many new and lengthened runways which have been added to the nation's airports in recent years, limited runway availability remains a major contributing factor to operational delays. Many high-density airports have gained operational experience with intersecting runways which clearly indicates that simultaneous operations are safe and feasible. Tower controllers may authorize simultaneous landings and, at designated locations, simultaneous landing and takeoffs on intersecting runways when the following conditions are met:

(1) The runways are dry and the controller has received no reports that braking action is less than good.

(2) Simultaneous landings are conducted in VFR conditions unless visual separation is applied. Simultaneous landings and takeoffs are conducted in VFR conditions only and only between sunrise and sunset.

(3) Instructions are issued to restrict one aircraft from entering the intersecting runway being used by another aircraft.

(4) Traffic information issued is acknowledged by the pilots of both aircraft.

(5) The measured distance from runway threshold to intersection is issued if the pilot requests it.

(6) The conditions specified in 3, 4 and 5 are met at or before issuance of the landing clearance.

(7) The distance from landing threshold to the intersection is adequate for the category of aircraft being held short. Controllers are provided a general table of aircraft category/minimum runway length requirements as a guide. Operators of STOL aircraft should identify their aircraft as such on initial contact with the tower, unless a Letter of Agreement concerning this fact, is in effect. IT IS INCUMBENT ON THE PILOT TO DETERMINE HIS ABILITY TO HOLD SHORT OF AN INTERSECTION AFTER LANDING, WHEN SO INSTRUCTED.

b. THE SAFETY AND OPERATION OF AN AIRCRAFT REMAIN THE RESPONSIBILITY OF THE PILOT. IF FOR ANY REASON, (e.g. DIFFICULTY IN DISCERNING LOCATION OF AN INTERSECTION AT NIGHT, INABILITY TO HOLD SHORT OF AN INTERSECTION, WIND FACTORS, ETC.) A PILOT ELECTS TO USE THE FULL LENGTH OF THE RUNWAY, A DIFFERENT RUNWAY OR DESIRES TO OBTAIN THE DISTANCE FROM THE LANDING THRESHOLD TO THE INTERSECTION, HE IS EXPECTED TO PROMPTLY INFORM ATC ACCORDINGLY.

232. LOW APPROACH

a. A low approach (sometimes referred to as a low pass) is the go-around maneuver following approach. Instead of landing or making a touch-and-go, a pilot may wish to go around (low approach) in order to expedite a particular operation — a series of practice instrument approaches is an example of such an operation. Unless otherwise authorized by ATC, the low approach should be made straight ahead, with no turns or climb made until the pilot has made a thorough visual check for other aircraft in the area.

b. When operating within an airport traffic area, a pilot intending to make a low approach should contact the tower for approval. This request should be made prior to starting the final approach.

c. When operating to an airport not within an airport traffic area; a pilot intending to make a low approach should, prior to leaving the final approach fix inbound, so advise the FSS, UNICOM, or make a broadcast, as appropriate (See PARA—157 - TRAFFIC AIRPORT ADVISORY

PRACTICES AT AIRPORTS WHERE A TOWER IS NOT IN OPERATION).

233. TRAFFIC CONTROL LIGHT SIGNALS

a. The following procedures are used by ATCTs in the control of aircraft not equipped with radio. These same procedures will be used to control aircraft equipped with radio if radio contact cannot be established. ATC personnel use a directive traffic control signal which emits an intense narrow light beam of a selected color (either red, white, or green) when controlling traffic by light signals.

b. Although the traffic signal light offers the advantage that some control may be exercised over nonradio equipped aircraft, pilots should be cognizant of the disadvantages which are:

(1) The pilot may not be looking at the control tow at the time a signal is directed toward him.

(2) The directions transmitted by a light signal a very limited since only approval or disapproval of a pilo anticipated actions may be transmitted. No supplement explanatory information may be transmitted except by th use of the "General Warning Signal" which advises th pilot to be on the alert.

c. Between sunset and sunrise, a pilot wishing to a tract the attention of the control tower should turn o landing light and taxi the aircraft into a position, clear the active runway, so that light is visible to the tower. Th landing light should remain on until appropriate signa are received from the tower.

d. Portable traffic control light signals:

Color and Type of Signal	On the Ground	In Flight
STEADY GREEN	Cleared for take-off	Cleared to land
FLASHING GREEN	Cleared to taxi	Return for landing (to be followed by stea green at proper time)
STEADY RED	Stop	Give way to other aircraft and continu circling
FLASHING RED	Taxi clear of landing area (runway) in use	Airport unsafe-do not land
FLASHING WHITE	Return to starting point on airport	
ALTERNATING RED & GREEN	General Warning Signal-Exercise Extreme Caution	General Warning Signal-Exercise Extrem Caution

e. During daylight hours, acknowledge tower transmissions or light signals by moving the ailerons or rudder. At night, acknowledge by blinking the landing or navigation lights. If radio malfunction occurs after departing the parking area, watch the tower for light signals or monitor tower frequency.

234. RESERVED

235. COMMUNICATIONS

a. Pilots of departing aircraft should communicate with the control tower on the appropriate ground control/clearance delivery frequency prior to starting engines to receive engine start time, taxi and/or clearance information. Unless otherwise advised by the tower, remain on that frequency during taxiing and runup, then change to local control frequency when ready to request takeoff clearance. (See PARA. 161 - AUTOMATIC TERMINAL INFORMATION SERVICE (ATIS) for continuous broadcast of terminal information.)

b. The majority of ground control frequencies are in the 121.6—121.9 MHz bandwidth. Ground control frequencies are provided to eliminate frequency congestion on the tower (local control) frequency and are limited to communications between the tower and aircraft on the ground and between the tower and utility vehicles on the airport, provide a clear VHF channel for arriving and departing aircraft. They are used for issuance of taxi information, clearances, and other necessary contacts between the tower and aircraft or other vehicles operated on the airport. A pilot who has just landed should not change from the tower fr quency to the ground control frequency until he is direct to do so by the controller. Normally, only one ground co trol frequency is assigned at an airport; however, at loc tions where the amount of traffic so warrants, a secon ground control frequency and/or another frequency des nated as a clearance delivery frequency, may be assigne

c. A controller may omit the ground or local contr frequency if the controller believes the pilot knows whic frequency is in use. If the ground control frequency is i the 121 MHz bandwidth the controller may omit the nu bers preceding the decimal point; (e.g., 121.7, "CONTAC GROUND POINT SEVEN.") However, if any doubt exis as to what frequency is in use, the pilot should promp request the controller to provide that information.

d. Controllers will normally avoid issuing a radio fr quency change to helicopters, known to be single-pilot which are hovering, air taxiing, or flying near the grou At times, it may be necessary for pilots to alert ATC r garding single pilot operations to minimize delay of ess tial ATC communications. Whenever possible, ATC instru tions will be relayed through the frequency being mo tored until a frequency change can be accomplished. Yo must promptly advise ATC if you are unable to comp with a frequency change. Also, you should advise ATC i you must land to accomplish the frequency change unl it is clear the landing, e.g., on a taxiway or in a helicopt operating area, will have no impact on other air traffic.

236. GATE HOLDING DUE TO DEPARTURE DELAYS

a. Pilots should contact ground control or clearance delivery prior to starting engines as gate hold procedures will be in effect whenever departure delays exceed or are anticipated to exceed 5 minutes. The sequence for departure will be maintained in accordance with initial call up unless modified by flow control restrictions. Pilots should monitor the ground control or clearance delivery frequency for engine startup advisories or new proposed start time if the delay changes.

b. The tower controller will consider that pilots of turbine powered aircraft are ready for takeoff when they reach the runway or warm-up block unless advised otherwise.

237. VFR FLIGHTS IN TERMINAL AREAS

Use reasonable restraint in exercising the prerogative of VFR flight, especially in terminal areas. The weather minimums and distances from clouds are minimums. Giving yourself a greater margin in specific instances is just good judgment.

a. Approach Area.

Conducting a VFR operation in a Control Zone when the official visibility is 3 or 4 miles is not prohibited, but good judgment would dictate that you keep out of the approach area.

b. Reduced Visibility.

It has always been recognized that precipitation reduces forward visibility. Consequently, although again it may be perfectly legal to cancel your IFR flight plan at any time you can proceed VFR, it is good practice, when precipitation is occurring, to continue IFR operation into a terminal area until you are reasonably close to your destination.

c. Simulated Instrument Flights.

In conducting simulated instrument flights, be sure that the weather is good enough to compensate for the restricted visibility of the safety pilot and your greater concentration on your flight instruments. Give yourself a little greater margin when your flight plan lies in or near a busy airway or close to an airport.

238. VFR HELICOPTER OPERATIONS AT CONTROLLED AIRPORTS

a. GENERAL

(1) The following ATC procedures and phraseologies recognize the unique capabilities of helicopters and were developed to improve service to all users. Helicopter design characteristics and user needs often require operations from movement and nonmovement areas within the airport boundary. In order for ATC to properly apply these procedures, it is essential that pilots familiarize themselves with the local operations and make it known to controllers when additional instructions are necessary.

(2) Insofar as possible, helicopter operations will be instructed to avoid the flow of fixed-wing aircraft to minimize overall delays; however, there will be many situations where faster/larger helicopters may be integrated with fixed-wing aircraft for the benefit of all concerned. Examples would include IFR flights, avoidance of noise sensitive areas, or use of runways/taxiways to minimize the hazardous effects of rotor downwash in congested areas.

(3) Because helicopter pilots are intimately familiar with the effects of rotor downwash, they are best qualified to determine if a given operation can be conducted safely. Accordingly, the pilot has the final authority with respect to the specific airspeed/altitude combinations. ATC clearances are in no way intended to place the helicopter in a hazardous position. It is expected that pilots will advise ATC if a specific clearance will cause undue hazards to persons or property.

b. Controllers normally limit ATC ground service and instruction to ***movement*** areas; therefore, operations from ***nonmovement*** areas are conducted at pilot discretion and should be based on local policies, procedures, or letters of agreement. In order to maximize the flexibility of helicopter operations, it is necessary to rely heavily on sound pilot judgment. For example, hazards such as debris, obstructions, vehicles, or personnel must be recognized by the pilot, and action should be taken as necessary to avoid such hazards. Taxi, hover taxi, and air taxi operations are considered to be ground movements. Helicopters conducting such operations are expected to adhere to the same conditions, requirements, and practices as apply to other ground taxiing and ATC procedures in the AIM.

(1) The phraseology ***taxi*** is used when it is intended or expected that the helicopter will taxi on the airport surface, either via taxiways or other prescribed routes. ***Taxi*** is used primarily for helicopters equipped with wheels or in response to a pilot request. Preference should be given to this procedure whenever it is necessary to minimize effects of rotor downwash.

(2) Pilots may request a ***hover taxi*** when a slow forward movement is desired, or when it may be appropriate to move very short distances. Pilots should avoid this procedure if rotor downwash is likely to cause damage to parked aircraft, or if blowing dust/snow could obscure visibility. If it is necessary to operate above 25 feet AGL when hover taxiing, the pilot should initiate a request to ATC.

(3) ***Air taxi*** is the preferred method for helicopter ground movements on airports provided ground operations and conditions permit. Unless otherwise requested or instructed, pilots are expected to remain below 100 feet AGL. However, if a higher than normal airspeed or altitude is desired, the request should be made prior to lift-off. The pilot is solely responsible for selecting a safe airspeed for the altitude/operation being conducted. Use of ***air taxi*** enables the pilot to proceed at an optimum airspeed/altitude, minimize downwash effect, conserve fuel, and expedite movement from one point to another. Helicopters should avoid overflight of other aircraft, vehicles, and personnel during air-taxi operations. Caution must be exercised concerning active runways and pilots must be certain that air taxi instructions are understood. Special precautions may be necessary at unfamiliar airports or airports with multiple/intersecting active runways. The taxi procedures in PARA 241 thru PARA 243 also apply. (See Pilot/Controller Glossary - Taxi, Hover Taxi, Air Taxi definitions.)

c. Takeoff and Landing Procedures

(1) Helicopter operations may be conducted from a runway, taxiway, portion of a landing strip, or any clear area which could be used as a landing site such as the scene of an accident, a construction site, or the roof of a building. The terms used to describe designated areas from which helicopters operate are: movement area, landing/takeoff area, apron/ramp, heliport and helipad (see Pilot/Controller Glossary). These areas may be improved or unimproved and may be separate from or located on an airport/heliport. ATC will issue takeoff clearances from ***movement*** areas other than active runways, or in diverse directions from active runways, with additional instructions as necessary. Whenever possible, takeoff clearance will be issued in lieu of extended hover/air taxi operations. Phraseology will be "CLEARED FOR TAKEOFF FROM (taxiway, helipad, runway number, etc.) MAKE RIGHT/LEFT TURN FOR (direction, heading, NAVAID radial) DEPARTURE/DEPARTURE ROUTE (number, name, etc.)." Unless requested by the pilot, downwind takeoffs will not be issued if the tailwind exceeds 5 knots.

(2) Pilots should be alert to wind information as well as to wind indications in the vicinity of the helicopter. ATC should be advised of the intended method of departing. A pilot request to takeoff in a given direction indicates that the pilot is willing to accept the wind condition and controllers will honor the request if traffic permits. Departure points could be a significant distance from the control tower and it may be difficult or impossible for the controller to determine the helicopter's relative position to the wind.

(3) If takeoff is requested from ***nonmovement*** areas, the phraseology "PROCEED AS REQUESTED" will be used. Additional instructions will be issued as necessary. The pilot is responsible for operating in a safe manner and should exercise due caution. When other known traffic is not a factor and takeoff is requested from an area not visible from the tower, an area not authorized for helicopter use, an unlighted area at night, or an area not on the airport, the phraseology "DEPARTURE FROM (location) WILL BE AT YOUR OWN RISK (with reason, and additional instructions as necessary)."

(4) Similar phraseology is used for helicopter landing operations. Every effort will be made to permit helicopters to proceed direct and land as near as possible to their final destination on the airport. Traffic density, the need for detailed taxiing instructions, frequency congestion, or other factors may affect the extent to which service can be expedited. As with ground movement operations, a high degree of pilot/controller cooperation and communication is necessary to achieve safe and efficient operations.

239. RESERVED

240. FUEL ADVISORY DEPARTURE (FAD) PROCEDURES

a. The Air Traffic Operations Service has undertaken several programs designed to conserve aviation fuel. FAD Procedures is one such program.

b. FAD is designed to operate when conditions at an airport are such that arrival delays will exceed one hour, and that the hour or more delay will continue for an extended period. FAD is not designed to eliminate delays, but to absorb, with engine off, any excess of the anticipated one hour delay at the departure terminal. This means absorbing the excess of the hour arrival delay at the departu gate, being assigned a new departure time and then p ceeding to destination and holding an hour or less at t destination.

c. Subject to the availability of holding space, F offers the pilot or operator options to absorb the delay the air or on the ground. Of course, delay on the grou with engine off is the key to fuel savings. Options inclu ground delay, airborne delay, split ground and airbor delay, intermediate landing (delay at the intermediate a port is credited) or flight substitution.

NOTE.— FAD procedures were tested in a live environment the Chicago O'Hare Airport. The tests and subsequent progra indicated that significant fuel savings can be realized when t ground delay option is exercised.

d. System users are appraised of the imposition of FA through ATC Systems Command Center advisories tra mitted to all FSSs, and Airline Dispatch Offices. When n tified that FAD procedures are in effect, operators are r quested to file flight plans to the impacted airport at lea 4 hours in advance of departure. The flight plan should i clude the estimated time en route.

241. TAXIING

a. General: Approval must be obtained prior to movi an aircraft or vehicle onto the movement area during t hours an airport traffic control tower is in operation.

(1) Always state your position on the airport whe calling the tower for taxi instructions.

(2) The movement area is normally described in loc bulletins issued by the airport manager or control tow These bulletins may be found in FSSs, fixed base operat offices, air carrier offices and operations offices.

(3) The control tower also issues bulletins describi areas where they cannot provide ATC service due to non sibility or other reasons.

(4) A clearance must be obtained prior to taxiing on runway, taking off, or landing during the hours an airpo traffic control tower is in operation.

(5) When ATC clears an aircraft to "taxi to" an a signed takeoff runway, the absence of holding instructio authorizes the aircraft to "cross" all runways which th taxi route intersects except the assigned takeoff runway. does not include authorization to "taxi onto" or "cross" th assigned takeoff runway at any point. In order to preclu misunderstandings in radio communications, ATC will n use the word "cleared" in conjunction with authorizatio for aircraft to taxi.

(6) In the absence of holding instructions, a clearan to "taxi to" any point other than an assigned take runway is a clearance to cross all runways that interse the taxi route to that point.

b. ATC clearances or instructions pertaining to taxii are predicated on known traffic and known physical a port conditions. Therefore, it is important that pilots cle ly understand the clearance or instruction. Although a ATC clearance is issued for taxiing purposes, when opera ing in accordance with the FARs, it is the responsibility o the pilot to avoid collision with other aircraft. Since "th pilot in command of an aircraft is directly responsible fo and is the final authority as to, the operation of that ai

craft" the pilot should obtain clarification of any clearance or instruction which is not understood. (See PARA—540.)

c. At those airports where the U.S. Government operates the control tower and ATC has authorized noncompliance with the requirement for two-way radio communications while operating within the airport traffic area, or at those airports where the U.S. Government does not operate the control tower and radio communications cannot be established, pilots shall obtain a clearance by visual light signal prior to taxiing on a runway and prior to takeoff and landing.

d. The following phraseologies and procedures are used in radio-telephone communications with aeronautical ground stations.

(1) Request for taxi instructions prior to departure: State your aircraft identification, location, type of operation planned (VFR or IFR) and the point of first intended landing.

EXAMPLE:

Aircraft: "WASHINGTON GROUND, BEECHCRAFT ONE THREE ONE FIVE NINER AT HANGAR EIGHT, READY TO TAXI, IFR TO CHICAGO OVER"

Tower: "BEECHCRAFT ONE THREE ONE FIVE NINER, TAXI TO RUNWAY THREE SIX, WIND ZERO THREE ZERO AT TWO FIVE, ALTIMETER THREE ZERO ZERO FOUR, HOLD SHORT OF RUNWAY THREE."

(2) Receipt of ATC clearance: ARTCC clearances are relayed to pilots by airport traffic controllers in the following manner:

EXAMPLE:

Tower: BEECHCRAFT ONE THREE ONE FIVE NINER CLEARED TO THE CHICAGO MIDWAY AIRPORT, VIA VICTOR EIGHT, MAINTAIN EIGHT THOUSAND, OVER.

Aircraft: "BEECHCRAFT ONE THREE ONE FIVE NINER CLEARED TO THE CHICAGO MIDWAY AIRPORT, VIA VICTOR EIGHT, MAINTAIN EIGHT THOUSAND, OVER."

NOTE.— Normally, an ATC IFR clearance is relayed to a pilot by the ground controller. At busy locations, however, pilots may be instructed by the ground controller to "CONTACT CLEARANCE DELIVERY" on a frequency designated for this purpose. No surveillance or control over the movement of traffic is exercised by this position of operation.

(3) Request for taxi instructions after landing: State your aircraft identification, location, and that you request taxi instructions.

EXAMPLE:

Aircraft: "DULLES GROUND BEECHCRAFT ONE FOUR TWO SIX ONE CLEARING RUNWAY ONE RIGHT ON TAXIWAY E3, REQUEST CLEARANCE TO PAGE."

Tower: "BEECHCRAFT ONE FOUR TWO SIX ONE, TAXI TO PAGE VIA TAXIWAYS E3, E1 and E9."

242. TAXI DURING LOW VISIBILITY

a. Pilots and aircraft operators should be constantly aware that during certain low visibility conditions the movement of aircraft and vehicles on airports may not be visible to the tower controller. This may prevent visual confirmation of an aircraft's adherence to taxi instructions. Pilots should, therefore, exercise extreme vigilance and proceed cautiously under such conditions.

b. Of vital importance is the need for pilots to notify the controller when difficulties are encountered or at the first indication of becoming disoriented. Pilots should proceed with extreme caution when taxiing toward the sun. When vision difficulties are encountered pilots should immediately inform the controller.

243. EXITING THE RUNWAY AFTER LANDING

After landing, unless otherwise instructed by the control tower, continue to taxi in the landing direction, proceed to the nearest suitable taxiway and exit the runway without delay. Do not turn on to another runway or make a 180 degree turn to taxi back on an active runway or change to ground control frequency while on the active runway without authorization from the tower.

244. PRACTICE INSTRUMENT APPROACHES

a. Various air traffic incidents have indicated the necessity for adoption of measures to achieve more organized and controlled operations where practice instrument approaches are conducted. Practice instrument approaches are considered to be instrument approaches made by either a VFR aircraft not on an IFR flight plan or an aircraft on an IFR flight plan. To achieve this and thereby enhance air safety, it is Air Traffic Operations Service policy to provide for separation of such operations at locations where approach control facilities are located and, as resources permit, at certain other locations served by ARTCCs or parent approach control facilities. Pilot requests to practice instrument approaches may be approved by ATC subject to traffic and workload conditions. Pilots should anticipate that in some instances the controller may find it necessary to deny approval or withdraw previous approval when traffic conditions warrant. It must be clearly understood, however, that even though the controller may be providing separation, pilots on VFR flight plans are required to comply with basic visual flight rules (FAR—91.105). Application of ATC procedures or any action taken by the controller to avoid traffic conflictions does not relieve IFR and VFR pilots of their responsibility to see and avoid other traffic while operating in VFR conditions. (FAR—91.67) In addition to the normal IFR separation minima (which includes visual separation) during VFR conditions, 500 feet vertical separation may be applied between VFR aircraft and between a VFR aircraft and the IFR aircraft. Pilots not on IFR flight plans desiring practice instrument approaches should always state 'practice' when making requests to ATC. Controllers will instruct VFR aircraft requesting an instrument approach to maintain VFR. This is to preclude misunderstandings between the pilot and controller as to the status of the aircraft. If the pilot wishes to proceed in accordance with instrument flight rules, he must specifically request and obtain, an IFR clearance.

b. Before practicing an instrument approach, pilots should inform the approach control facility or the tower of the type of practice approach they desire to make and how they intend to terminate it, i.e., full-stop landing, touch-and-go, or missed or low approach maneuver. This information may be furnished progressively when conducting a series of approaches. Pilots on an IFR flight plan, who have made a series of instrument approaches to full stop landings should inform ATC when they make their final landing. The controller will control flights practicing instrument approaches so as to ensure that they do not disrupt the flow of arriving and departing itinerant IFR or VFR aircraft. The priority afforded itinerant aircraft over practice instrument approaches is not intended to be so rigidly applied that it causes grossly inefficient application of services. A minimum delay to itinerant traffic may be appropriate to allow an aircraft practicing an approach to complete that approach.

c. At airports without a tower, pilots wishing to make practice instrument approaches should notify the facility having control jurisdiction of the desired approach as indicated on the approach chart. All approach control facilities and ARTCCs are required to publish a facility bulletin depicting those airports where they provide standard separation to both VFR and IFR aircraft conducting practice instrument approaches.

d. The Controller will provide approved separation between both VFR and IFR aircraft when authorization is granted to make practice approaches to airports where an approach control facility is located and to certain other airports served by approach control or an ARTCC. Controller responsibility for separation of VFR aircraft begins at the point where the approach clearance becomes effective, or when the aircraft enters TRSA/TCA airspace, whichever comes first.

e. VFR aircraft practicing instrument approaches are not automatically authorized to execute the missed approach procedure. This authorization must be specifically requested by the pilot and approved by the controller. Separation will not be provided unless the missed approach has been approved by ATC.

f. Except in an emergency, aircraft cleared to practice instrument approaches must not deviate from the approved procedure until cleared to do so by the controller.

g. At radar approach control locations when a full approach procedure (procedure turn, etc.,) cannot be approved, pilots should expect to be vectored to a final approach course for a practice instrument approach which is compatible with the general direction of traffic at that airport.

h. When granting approval for a practice instrument approach, the controller will usually ask the pilot to report to the tower prior to or over the final approach fix inbound.

i. When authorization is granted to conduct practice instrument approaches to an airport with a tower, but where approved standard separation is not provided to aircraft conducting practice instrument approaches, the tower will approve the practice approach, instruct the aircraft to maintain VFR and issue traffic information, as required.

j. When an aircraft notifies a FSS providing Airport Advisory Service to the airport concerned of the intent to conduct a practice instrument approach and whether or not separation is to be provided, the pilot will be instructed to contact the appropriate facility on a specified frequency prior to initiating the approach. At airports where separation is not provided, the FSS will acknowledge the message and issue known traffic information but will neither prove or disapprove the approach.

k. Pilots conducting practice instrument approa should be particularly alert for other aircraft operating the local traffic pattern or in proximity to the airport.

245. OPTION APPROACH

The "Cleared for the Option" procedure will permit instructor, flight examiner or pilot the option to mak touch-and-go, low approach, missed approach, stop-and or full stop landing. This procedure can be very benefic in a training situation in that neither the student pilot examinee would know what maneuver would be acc plished. The pilot should make his request for this pro dure passing the final approach fix inbound on an inst ment approach or entering downwind for a VFR traf pattern. The advantages of this procedure as a training are that it enables an instructor or examiner to obtain reaction of a trainee or examinee under changing con tions, the pilot would not have to discontinue an appro in the middle of the procedure due to student error or p proficiency requirements, and finally it allows more fle bility and economy in training programs. This proced will only be used at those locations with an operation control tower and will be subject to ATC approval.

246. USE OF AIRCRAFT LIGHTS

a. Aircraft position and anticollision lights are requi to be lighted on aircraft operated from sunset to sunr Anticollision lights, however, need not be lighted when pilot in command determines that, because of operat conditions, it would be in the interest of safety to turn the lights (FAR—91.73). For example, strobe lights sho be turned off on the ground when they adversely aff ground personnel or other pilots, and in flight when the are adverse reflection from clouds.

b. An aircraft anticollision light system can use one more rotating beacons and/or strobe lights, be colo either red or white, and have different (higher than mi mum) intensities when compared to other aircraft. Ma aircraft have both a rotating beacon and a strobe li system.

c. The FAA has a voluntary pilot safety program, *Op ation Lights On*, to enhance the *see-and-avoid* conce Pilots are encouraged to turn on their anticollision lig any time the engine(s) are running, day or night. Pilots further encouraged to turn on their landing lights wh operating within 10 miles of any airport, day or night, conditions of reduced visibility and in areas where flocks birds may be expected, i.e., coastal areas, lake are around refuse dumps, etc. Although turning on airc lights does enhance the *see-and-avoid* concept, pilots sho not become complacent about keeping a sharp lookout other aircraft. Not all aircraft are equipped with lights some pilots may not have their lights turned on. Airc manufacturer's recommendations for operation of land lights and electrical systems should be observed.

d. Prop and jet blast forces generated by large airc have overturned or damaged several smaller aircraft t ing behind them. To avoid similar results, and in the in est of preventing upsets and injuries to ground personnel from such forces, the FAA recommends that air carriers and commercial operators turn on their rotating beacons anytime their aircraft engines are in operation. General aviation pilots using rotating beacon equipped aircraft are also encouraged to participate in this program which is designed to alert others to the potential hazard. Since this is a voluntary program, exercise caution and do not rely solely on the rotating beacon as an indication that aircraft engines are in operation.

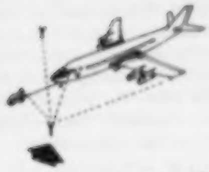
247. FLIGHT INSPECTION/'FLIGHT CHECK' AIRCRAFT IN TERMINAL AREAS

a. *Flight check* is a call sign used to alert pilots and air traffic controllers when a FAA aircraft is engaged in flight inspection/certification of NAVAIDs and flight procedures. Flight Check aircraft fly preplanned high/low altitude flight patterns such as grids, orbits, DME arcs, and tracks, including low passes along the full length of the runway to verify NAVAID performance. In most instances, these flight checks are being automatically recorded and/or flown in an automated mode.

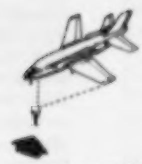
b. Pilots should be especially watchful and avoid the flight paths of any aircraft using the call sign "Flight Check" or "Flight Check recorded." The latter call sign, e.g. "Flight Check 47 recorded" indicates that automated flight inspections are in progress in terminal areas. These flights will normally receive special handling from ATC. Pilot patience and cooperation in allowing uninterrupted recordings can significantly help expedite flight inspections, minimize costly, repetitive runs, and reduce the burden on the U.S. taxpayer.

248—258 RESERVED.

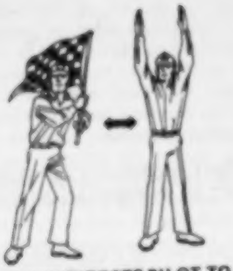
259. HAND SIGNALS



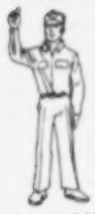
SIGNALMAN DIRECTS TOWING



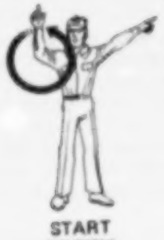
SIGNALMAN'S POSITION



FLAGMAN DIRECTS PILOT TO SIGNALMAN IF TRAFFIC CONDITIONS REQUIRE

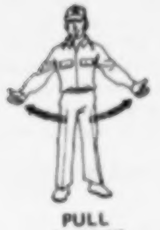


ALL CLEAR (O.K.)

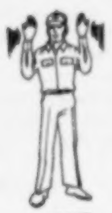


POINT TO ENGINE TO BE STARTED

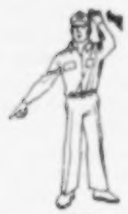
START ENGINE



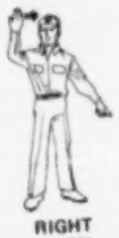
PULL CHOCKS



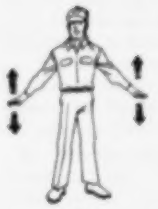
COME AHEAD



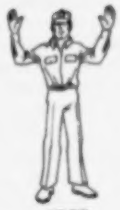
LEFT TURN



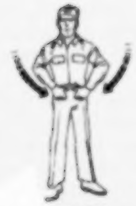
RIGHT TURN



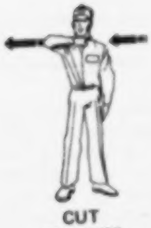
SLOW DOWN



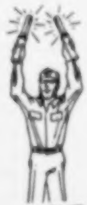
STOP



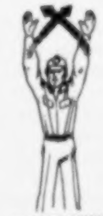
NSERT CHOCKS



CUT ENGINES



NIGHT OPERATION (Uses same hand movements as day operation)



EMERGENCY STOP

Section 4. ATC CLEARANCES/SEPARATIONS

260. CLEARANCE

a. A clearance issued by ATC is predicated on known traffic and known physical airport conditions. An ATC clearance means an authorization by ATC, for the purpose of preventing collision between known aircraft, for an aircraft to proceed under specified conditions within controlled airspace. IT IS NOT AUTHORIZATION FOR A PILOT TO DEVIATE FROM ANY RULE REGULATION OR MINIMUM ALTITUDE NOR TO CONDUCT UNSAFE OPERATION OF HIS AIRCRAFT.

b. FAR—91.3(a) states: "The pilot in command of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft." If ATC issues a clearance that would cause a pilot to deviate from a rule or regulation, or in the pilot's opinion, would place the aircraft in jeopardy, IT IS THE PILOT'S RESPONSIBILITY TO REQUEST AN AMENDED CLEARANCE. Similarly, if a pilot prefers to follow a different course of action, such as make a 360 degree turn for spacing to follow traffic when established in a landing or approach sequence, land on a different runway, takeoff from a different intersection, takeoff from the threshold instead of an intersection or delay his operation, HE IS EXPECTED TO INFORM ATC ACCORDINGLY. When he requests a different course of action, however, the pilot is expected to cooperate so as to preclude disruption of traffic flow or creation of conflicting patterns. The pilot is also expected to use the appropriate aircraft call sign to acknowledge all ATC clearances, frequency changes, or advisory information.

c. When weather conditions permit, during the time an IFR flight is operating, it is the direct responsibility of the pilot to avoid other aircraft since VFR flights may be operating in the same area without the knowledge of ATC. Traffic clearances provide standard separation only between IFR flights.

261. CLEARANCE PREFIX

A clearance, control information, or a response to a request for information originated by an ATC facility and relayed to the pilot through an air to ground communication station will be prefixed by "ATC CLEARS," "ATC ADVISES," or "ATC REQUESTS."

262. CLEARANCE ITEMS

ATC clearances normally contain the following:

a. Clearance Limit. — The traffic clearance issued prior to departure will normally authorize flight to the airport of intended landing. Under certain conditions, at some locations a short-range clearance procedure is utilized whereby a clearance is issued to a fix within or just outside of the terminal area and the pilot is advised of the frequency on which he will receive the long-range clearance direct from the center controller.

b. Departure Procedure. — Headings to fly and altitude restrictions may be issued to separate a departure from other air traffic in the terminal area. (See PARA—322 - ABBREVIATED IFR DEPARTURE CLEARANCE PROCEDURES and PARA—325 - INSTRUMENT DEPARTURES.) Where the volume of traffic warrants, SIDs have been developed.

c. Route of Flight.

(1) Clearances are normally issued for the altitude or flight level and route filed by the pilot. However, due to traffic conditions, it is frequently necessary for ATC to specify an altitude or flight level or route different from that requested by the pilot. In addition, flow patterns have been established in certain congested areas, or between congested areas, whereby traffic capacity is increased by routing all traffic on preferred routes. Information on these flow patterns is available in offices where preflight briefing is furnished or where flight plans are accepted.

(2) When required, air traffic clearances include data to assist pilots in identifying radio reporting points. It is the responsibility of the pilot to notify ATC immediately if his radio equipment cannot receive the type of signals he must utilize to comply with his clearance.

d. Altitude Data.

(1) The altitude or flight level instructions in an ATC clearance normally require that a pilot "MAINTAIN" the altitude or flight level at which the flight will operate when in controlled airspace. Altitude or flight level changes while en route should be requested prior to the time the change is desired.

(2) When possible, if the altitude assigned is different from the altitude requested by the pilot, ATC will inform the pilot when to expect climb or descent clearance or to request altitude change from another facility. If this has not been received prior to crossing the boundary of the ATC facility's area and assignment at a different altitude is still desired, the pilot should reinitiate his request with the next facility.

(3) The term "CRUISE" may be used instead of "MAINTAIN" to assign a block of airspace, to a pilot, from the minimum IFR altitude up to and including the altitude specified in the cruise clearance. The pilot may level off at any intermediate altitude within this block of airspace. Climb/descent within the block is to be made at the discretion of the pilot. However, once the pilot starts descent and verbally reports leaving an altitude in the block, he may not return to that altitude without additional ATC clearance.

NOTE.— See definition of CRUISE in the PILOT CONTROLLER GLOSSARY.

e. Holding Instructions.

(1) Whenever an aircraft has been cleared to a fix other than the destination airport and delay is expected, it is the responsibility of the ATC controller to issue complete holding instructions (unless the pattern is charted), an EFC time, and his best estimate of any additional en route/terminal delay.

(2) If the holding pattern is charted and the controller doesn't issue complete holding instructions, the pilot is expected to hold as depicted on the appropriate chart. When the pattern is charted, the controller may omit all holding instructions except the charted holding direction and the statement *AS PUBLISHED*, e.g., "*HOLD EAST AS PUBLISHED.*" Controllers shall always issue complete holding instructions when pilots request them.

NOTE.— · Only those holding patterns depicted on U.S. Government or commercially produced (meeting FAA requirements) *Low/High Altitude En route, and Area or Star charts* should be used.

(3) If no holding pattern is charted and holding instructions have not been issued, the pilot should ask ATC for holding instructions prior to reaching the fix. This procedure will eliminate the possibility of an aircraft entering a holding pattern other than that desired by ATC. If the pilot is unable to obtain holding instructions prior to reaching the fix (due to frequency congestion, stuck microphone, etc.), he should hold in a standard pattern on the course on which he approached the fix and request further clearance as soon as possible. In this event, the altitude/flight level of the aircraft at the clearance limit will be protected so that separation will be provided as required.

(4) When an aircraft is 3 minutes or less from a clearance limit and a clearance beyond the fix has not been received, the pilot is expected to start a speed reduction so that he will cross the fix, initially, at or below the maximum holding airspeed.

(5) When no delay is expected, the controller should issue a clearance beyond the fix as soon as possible and, whenever possible, at least 5 minutes before the aircraft reaches the clearance limit.

(6) Pilots should report to ATC the time and altitude/flight level at which the aircraft reaches the clearance limit and report leaving the clearance limit.

NOTE.— In the event of two-way communications failure, pilots are required to comply with FAR 91.127.

263. AMENDED CLEARANCES

a. Amendments to the initial clearance will be issued at any time an air traffic controller deems such action necessary to avoid possible confliction between aircraft. Clearances will require that a flight "hold" or change altitude prior to reaching the point where standard separation from other IFR traffic would no longer exist.

NOTE.— Some pilots have questioned this action and requested "traffic information" and were at a loss when the reply indicated "no traffic report." In such cases the controller has taken action to prevent a traffic confliction which would have occurred at a distant point.

b. A pilot may wish an explanation of the handling of his flight at the time of occurrence; however, controllers are not able to take time from their immediate control duties nor can they afford to overload the ATC communications channels to furnish explanations. Pilots may obtain an explanation by directing a letter or telephone call to the chief controller of the facility involved.

c. The pilot has the privilege of requesting a different clearance from that which has been issued by ATC if he feels that he has information which would make another course of action more practicable or if aircraft equipment limitations or company procedures forbid compliance with the clearance issued.

264. SPECIAL VFR CLEARANCES

a. An ATC clearance must be obtained *prior* to operating within a control zone when the weather is less than that required for VFR flight. A VFR pilot may request and be given a clearance to enter, leave or operate within most control zones in special VFR conditions, traffic permitting, and providing such flight will not delay IFR operations. All special VFR flights must remain clear of clouds. The visibility requirements for Special VFR fixed-wing aircraft are:

(1) One mile flight visibility for operations within the control zone.

(2) One mile ground visibility if taking off or landing.

b. When a control tower is located within the control zone, requests for clearances should be to the tower. If no tower is located within the control zone, a clearance may be obtained from the nearest tower, FSS or center.

c. It is not necessary to file a complete flight plan with the request for clearance but the pilot should state his intentions in sufficient detail to permit ATC to fit his flight into the traffic flow. The clearance will not contain a specific altitude as the pilot must remain clear of clouds. The controller may require the pilot to fly at or below a certain altitude due to other traffic, but the altitude specified will permit flight at or above the minimum safe altitude. In addition, at radar locations, flighus may be vectored if necessary for control purposes or on pilot request.

NOTE. The pilot is responsible for obstacle or terrain clearance (reference FAR—91.79).

d. Special VFR clearances are effective within control zones only. ATC does not provide separation after an aircraft leaves the control zone on a special VFR clearance.

e. Special VFR operations by fixed-wing aircraft are prohibited in some control zones due to the volume of IFR traffic. A list of these control zones is contained in FAR—93.113. They are also depicted on Sectional Aeronautical Charts.

f. ATC provides separation between special VFR flights and between these flights and other IFR flights.

g. Special VFR operations by fixed-wing aircraft are prohibited between sunset and sunrise unless the pilot is instrument rated and the aircraft is equipped for IFR flight.

265. PILOT RESPONSIBILITY UPON CLEARANCE ISSUANCE

a. RECORD ATC CLEARANCE — When conducting an IFR operation, make a written record of your clearance. The specified conditions which are a part of your air traffic clearance may be somewhat different from those included in your flight plan. Additionally, ATC may find it necessary to ADD conditions, such as particular departure route. The very fact that ATC specifies different or additional conditions means that other aircraft are involved in the traffic situation.

b. ATC CLEARANCE/INSTRUCTION READBACK — Pilots of airborne aircraft should read back *those parts* of

ATC clearances and instructions containing altitude assignments or vectors, as a means of mutual verification. The readback of the "numbers" serves as a double check between pilots and controllers and reduces the kinds of communications errors that occur when a number is either "misheard" or is incorrect.

(1) Precede all readbacks and acknowledgements with the aircraft identification. This aids controllers in determining that the correct aircraft received the clearance or instruction. The requirement to include aircraft identification in all readbacks and acknowledgements becomes more important as frequency congestion increases and when aircraft with similar call signs are on the same frequency.

(2) Read back altitudes, altitude restrictions, and vectors in the same sequence as they are given in the clearance or instruction.

(3) Altitudes contained in charted procedures such as SIDs, instrument approaches, etc., should not be read back unless they are specifically stated by the controller.

c. It is the responsibility of the pilot to accept or refuse the clearance issued.

266. IFR CLEARANCE WITH VFR RESTRICTIONS

a. A pilot on an IFR flight plan operating in VFR weather conditions, may request VFR ON TOP in lieu of an assigned altitude. This would permit the pilot to select an altitude or flight level of his choice (subject to any ATC restrictions.)

b. Pilots desiring to climb through a cloud, haze, smoke, or other meteorological formation and then either cancel their IFR flight plan or operate VFR ON TOP may request a climb to VFR ON TOP. The ATC authorization shall contain either a top report or a statement that no top report is available, and a request to report reaching VFR ON TOP. Additionally, the ATC authorization may contain a clearance limit, routing and an alternative clearance if VFR ON TOP is not reached by a specified altitude.

c. A pilot on an IFR flight plan, operating in VFR conditions, may request to climb/descend in VFR conditions.

d. ATC may not authorize VFR ON TOP/VFR CONDITIONS operations unless the pilot requests the VFR operation or a clearance to operate in VFR CONDITIONS will result in noise abatement benefits where part of the IFR departure route does not conform to an FAA approved noise abatement route or altitude.

e. When operating in VFR conditions with an ATC authorization to "MAINTAIN VFR ON TOP/MAINTAIN VFR CONDITIONS" pilots on IFR flight plans must:

(1) Fly at the appropriate VFR altitude as prescribed in FAR—91.109.

(2) Comply with the VFR visibility and distance from cloud criteria in FAR—91.105 (BASIC VFR WEATHER MINIMUMS.)

(3) Comply with instrument flight rules that are applicable to this flight (i.e., *minimum IFR altitudes*, position reporting, radio communications, course to be flown, adherence to ATC clearance, etc.).

NOTE.— Pilots should advise ATC prior to any altitude change to insure the exchange of accurate traffic information.

f. ATC authorization to "MAINTAIN VFR ON TOP" is not intended to restrict pilots so that they must operate only *above* an obscuring meteorological formation (layer). Instead, it permits operation above, below, between layers or in areas where there is no meteorological obscuration. It is imperative, however, that pilots understand that clearance to operate "VFR ON TOP/V[illegible]DITIONS" does not imply cancellation of the IF[illegible]n.

g. Pilots operating VFR C[illegible]R CONDITIONS, may receive traffic information [illegible] ATC, on other pertinent IFR or VFR aircraft. However, aircraft operating in TCAs/TRSAs shall be separated as required by FAA Handbook 7110.65.

NOTE.— When operating in VFR weather conditions, it is the pilot's responsibility to be vigilant so as to see and avoid other aircraft.

h. ATC will not authorize VFR or VFR ON TOP operations in PCAs. (See PARA—98 - POSITIVE CONTROL AREA.)

267—269. RESERVED

270. ADHERENCE TO CLEARANCE

a. When air traffic clearance has been obtained under either Visual or Instrument Flight Rules, the pilot in command of the aircraft shall not deviate from the provisions thereof unless an amended clearance is obtained. When ATC issues a clearance or instruction pilots are expected to execute its provisions upon receipt. ATC, in certain situations, will include the word "IMMEDIATELY" in a clearance or instruction to immpress urgency of an imminent situation and expeditious compliance by the pilot is expected and necessary for safety. The addition of a VFR or other restriction (i.e., climb or descent point or time, crossing altitude, etc.) does not authorize a pilot to deviate from the route of flight or any other provision of the ATC clearance.

b. When a heading is assigned or a turn is requested by ATC, pilots are expected to promptly initiate the turn, to complete the turn, and maintain the new heading unless issued additional instructions.

c. The term "at pilot's discretion" included in the altitude information of an ATC clearance means that ATC has offered the pilot the option to start climb or descent when he wishes. He is authorized to conduct the climb or descent at any rate he wishes, and to temporarily level off at any intermediate altitude he may desire. However, once he has vacated an altitude, he may not return to that altitude.

d. When ATC has not used the term "AT PILOT'S DISCRETION" nor imposed any climb or descent restrictions, pilots should initiate climb or descent promptly on acknowledgement of the clearance. Descend or climb at an optimum rate consistent with the operating characteristics of the aircraft to 1,000 feet above or below the assigned altitude, and then attempt to descend or climb at a rate of 500 feet per minute until the assigned altitude is reached. If at anytime the pilot is unable to climb or descend at a rate of at least 500 feet a minute, advise ATC. If it is necessary to level off at an intermediate altitude during climb or descent, advise ATC, except for level off at 10,000 feet MSL on descent or 3,000 feet above airport elevation (prior to entering an airport traffic area), when required for speed reduction (FAR—91.70).

NOTE.— Leveling off at 10,000 feet MSL on descent, or 3,000 feet above airport elevation (prior to entering in an airport traffic area), to comply with FAR—91.70 airspeed restrictions, is commonplace. Controllers anticipate this action and plan accordingly. Leveling off at any other time, on climb or descent, may seriously affect air traffic handling by ATC. Consequently, it is imperative that pilots make every effort to fulfill the above expected actions to aid ATC in safely handling and expediting traffic.

e. If the altitude information of an ATC DESCENT clearance includes a provision to "CROSS (fix) AT or AT OR ABOVE/BELOW (altitude)," "the manner in which the descent is executed to comply with the crossing altitude is at the pilot's discretion." This authorization to descend at pilot's discretion is only applicable to that portion of the flight to which the crossing altitude restriction applies, and the pilot is expected to comply with the crossing altitude as a provision of the clearance. Any other clearance in which pilot execution is optional will so state: "AT PILOT'S DISCRETION."

EXAMPLE:

"UNITED FOUR SEVENTEEN, DESCEND AND MAINTAIN SIX THOUSAND."

NOTE.— The pilot is expected to commence descent upon receipt of the clearance, and to descend at the suggested rates until reaching the assigned altitude of 6,000 feet.

EXAMPLE:

"UNITED FOUR SEVENTEEN, DESCEND AT PILOT'S DISCRETION, MAINTAIN SIX THOUSAND."

NOTE.— The pilot is authorized to conduct descent within the context of the term AT PILOT'S DISCRETION as described above.

EXAMPLE:

"UNITED FOUR SEVENTEEN, CROSS LAKEVIEW VOR AT OR ABOVE FLIGHT LEVEL TWO ZERO ZERO, DESCEND AND MAINTAIN SIX THOUSAND."

NOTE.— The pilot is authorized to conduct descent AT PILOT'S DISCRETION until reaching Lakeview VOR. He must comply with the clearance provision to cross the Lakeview VOR at or above FL 200. After passing Lakeview VOR, he is expected to descend at the suggested rates until reaching the assigned altitude of 6,000 feet.

EXAMPLE:

"UNITED FOUR SEVENTEEN, CROSS LAKEVIEW VOR AT SIX THOUSAND, MAINTAIN SIX THOUSAND."

NOTE.— The pilot is authorized to conduct descent AT PILOT'S DISCRETION, however, he must comply with the clearance provision to cross the Lakeview VOR at 6,000 feet.

EXAMPLE:

"UNITED FOUR SEVENTEEN, DESCEND NOW TO FLIGHT LEVEL TWO SEVEN ZERO, CROSS LAKEVIEW VOR AT OR BELOW ONE ZERO THOUSAND, DESCEND AND MAINTAIN SIX THOUSAND."

NOTE.— The pilot is expected to promptly execute and complete descent to FL 270 upon receipt of the clearance. After reaching FL 270 he is authorized to descend "at pilot's discretion" until reaching Lakeview VOR. He must comply with the clearance provision *to cross Lakeview VOR at or below* 10,000 feet. After Lakeview VOR he is expected to descend at the suggested rates until reaching 6,000 feet.

f. In case emergency authority is used to deviate from provisions of an ATC clearance, the pilot in command shall notify ATC as soon as possible and obtain an amended clearance. In an emergency situation which does not result in a deviation from the rules prescribed in FAR—91 but which requires ATC to give priority to an aircraft, the pilot of such aircraft shall, when requested by ATC, make a report within 48 hours of such emergency situation to the chief of that ATC facility.

g. The guiding principle is that the last ATC clearance has precedence over the previous ATC clearance. When the route or altitude in a previously issued clearance is amended, the controller will restate applicable altitude restrictions. If altitude to maintain is changed or restated, whether prior to departure or while airborne, and previously issued altitude restrictions are omitted, those altitude restrictions are canceled, including SID altitude restrictions.

EXAMPLE:

A departure flight receives a clearance to destination airport to maintain FL 290. The clearance incorporates a SID which has certain altitude crossing restrictions. Shortly after takeoff, the flight receives a new clearance changing the maintaining FL from 290 to 250. If the altitude restrictions are still applicable, the controller restates them.

EXAMPLE:

A departing aircraft is cleared to cross Mount Vernon intersection at or above 3,000 feet, Gordonville VOR at or above 12,000 feet, maintain FL 200. Shortly after departure, the altitude to be maintained is changed to FL 240. If the altitude restrictions are still applicable the controller issues an amended clearance as follows: "CROSS MOUNT VERNON INTERSECTION AT OR ABOVE THREE THOUSAND, CROSS GORDONVILLE VOR AT OR ABOVE ONE TWO THOUSAND, MAINTAIN FLIGHT LEVEL TWO FOUR ZERO.":

EXAMPLE:

An arriving aircraft is cleared to his destination airport via V45 Delta VOR direct, he is cleared to cross Delta VOR at 10,000 feet and then to, maintain 6,000 feet. Prior to Delta VOR, the controller issues amended clearance as follows: "TURN RIGHT HEADING ONE EIGHT ZERO FOR VECTOR TO RUNWAY THREE SIX ILS APPROACH, MAINTAIN 6,000."

NOTE.— Because the altitude restriction "cross Delta VOR at 10,000 feet" was omitted from the amended clearance, it is no longer in effect.

h. Pilots of turbojet aircraft equipped with afterburner engines should advise ATC prior to takeoff if they intend to use afterburning during their climb to the en route altitude. Often, the controller may be able to plan his traffic to accommodate a high performance climb and allow the pilot to climb to his planned altitude without restriction.

271. IFR SEPARATION STANDARDS

a. ATC effects separation of aircraft vertically by assigning different altitudes; longitudinally by providing an interval expressed in time or distance between aircraft on the same, converging, or crossing courses, and laterally by assigning different flight paths.

b. Separation will be provided between all aircraft operating on IFR flight plans except during that part of the flight (outside of a TCA or TRSA) being conducted on a VFR ON TOP/ VFR CONDITIONS clearance. Under these

conditions, ATC may issue traffic advisories but it is the sole responsibility of the pilot to be vigilant so as to see and avoid other aircraft.

c. When radar is employed in the separation of aircraft at the same altitude, a minimum of 3 miles separation is provided between aircraft operating within 40 miles of the radar antenna site, and 5 miles between aircraft operating beyond 40 miles from the antenna site. These minima may be increased or decreased in certain specific situations.

272. SPEED ADJUSTMENTS

a. To avoid excessive vectoring, ATC may request pilots of radar controlled aircraft to adjust speed.

b. ATC will express all speed adjustments in terms of knots based on indicated airspeed (IAS) in 10 knot increments except that at or above FL 240 speeds may be expressed in terms of mach numbers in .01 increments. The use of mach numbers is restricted to turbojet aircraft with mach meters.

c. Pilots complying with speed adjustments are expected to maintain a speed within plus or minus 10 knots or .02 mach number of the specified speed.

d. Unless pilot concurrence is obtained, ATC requests for speed adjustments will be in accordance with the following minima:

(1) To aircraft operating between FL 280 and 10,000 feet, a speed not less than 250 knots or the equivalent mach number.

(2) To turbine powered aircraft operating below 10,000 feet:

(a) A speed not less than 210 knots, except;

(b) Within 20 flying miles of the airport of intended landing, a speed not less than 170 knots.

(3) Reciprocating engine or turboprop aircraft within 20 flying miles of the runway threshold of the airport of intended landing, a speed not less than 150 knots.

(4) To departing aircraft:

(a) Turbine powered aircraft, a speed not less than 230 knots.

(b) Reciprocating engine aircraft, a speed not less than 150 knots.

e. When ATC combines a speed adjustment with a descent clearance, the sequence of delivery, with the word "then" between, indicates the expected order of execution;

EXAMPLE:

DESCEND AND MAINTAIN (altitude) THEN REDUCE SPEED TO (speed).

EXAMPLE:

REDUCE SPEED TO (speed) THEN DESCEND AND MAINTAIN (altitude).

NOTE.— The maximum speeds below 10,000 feet as established in FAR—91.70 still apply. If there is any doubt concerning the manner in which such a clearance is to be executed, request clarification from ATC.

f. If ATC determines (before an approach clearance is issued) that it is no longer necessary to apply speed adjustment procedures, they will inform the pilot to resume normal speed. Approach clearances supersede any prior speed adjustment assignments and pilots are expected to make their own speed adjustments, as necessary, to complete the approach. Under certain circumstances; however, it may be necessary for ATC to request further speed adjustments after approach clearance is issued to maintain separation between successive arrivals. Under such circumstances previously issued speed adjustments will be restated if that speed is to be maintained or additional speed adjustments are requested. ATC must obtain pilot concurrence for speed adjustments after approach clearances are issued.

g. Controllers have been advised that utilization of the minimum speeds set forth above for reciprocating engine aircraft will sometimes be impractical, since some aircraft in this category cruise at lower speeds and cannot attain the speeds specified. Speed adjustment of reciprocating engine or turbine powered aircraft which cannot attain the minimum speeds set forth shall be accomplished by requesting such flight to, if practical:

(1) Maintain a specified speed equivalent to that of the preceding or succeeding aircraft; or

(2) Increase or decrease speed utilizing increments of 10 knots or multiples thereof.

h. The pilots retain the prerogative of rejecting the application of speed adjustment by ATC if the minimum safe airspeed for any particular operation is greater than the speed adjustment. IN SUCH CASES, PILOTS ARE EXPECTED TO ADVISE ATC OF THE SPEED THAT WILL BE USED.

i. Pilots are reminded that they are responsible for rejecting the application of speed adjustment by ATC if, in their opinion, it will cause them to exceed the maximum indicated airspeed prescribed by FAR—91.70(a). IN SUCH CASES, THE PILOT IS EXPECTED TO SO INFORM ATC. Pilots operating at or above 10,000 feet MSL who are issued speed adjustments which exceed 250 knots IAS and are subsequently cleared below 10,000 feet MSL are expected to comply with FAR—91.70(a).

j. For operations in an airport traffic area, ATC is authorized to request or approve a speed greater than the maximum indicated airspeeds prescribed for operation within that airspace (FAR—91.70(b)).

k. When in communication with the ARTCC, pilots should, as a good operating practice, state any ATC assigned speed restriction on initial radio contact associated with an ATC communications frequency change.

273. RUNWAY SEPARATION

Tower controllers establish the sequence of arriving and departing aircraft by requiring them to adjust flight or ground operation as necessary to achieve proper spacing. They may "HOLD" an aircraft short of the runway to achieve spacing between it and an arriving aircraft; the controller may instruct a pilot to "EXTEND DOWNWIND" in order to establish spacing from an arriving or departing aircraft. At times a clearance may include the word "IMMEDIATE." For example: "CLEARED FOR IMMEDIATE TAKEOFF." In such cases "IMMEDIATE" is used for purposes of *air traffic separation.* It is up to the pilot to refuse the clearance if, in his opinion, compliance would adversely affect his operation. (See PARA—236 - GATE HOLDING DUE TO DEPARTURE DELAYS.)

274. VISUAL SEPARATION

a. Visual separation is a means employed by ATC to separate aircraft only in terminal areas. There are two methods employed to effect this separation:

(1) The tower controller sees the aircraft involved and issues instructions, as necessary, to ensure that the aircraft avoid each other.

(2) A pilot sees the other aircraft involved and upon instructions from the controller provides his own separation by maneuvering his aircraft to avoid it. This may involve following in-trail behind another aircraft or keeping it in sight until it is no longer a factor.

b. A pilot's acceptance of instructions to follow another aircraft or provide visual separation from it is an acknowledgment that the pilot will maneuver his/her aircraft as necessary to avoid the other aircraft or to maintain in-trail separation. In operations conducted behind heavy jet aircraft, it is also an acknowledgment that the pilot accepts the responsibility for wake turbulence separation.

c. WHEN A PILOT HAS BEEN TOLD TO FOLLOW ANOTHER AIRCRAFT OR TO PROVIDE VISUAL SEPARATION FROM IT HE/SHE SHOULD PROMPTLY NOTIFY THE CONTROLLER IF VISUAL CONTACT WITH THE OTHER AIRCRAFT IS LOST OR CANNOT BE MAINTAINED OR IF THE PILOT CANNOT ACCEPT THE RESPONSIBILITY FOR THE SEPARATION FOR ANY REASON.

d. Pilots should remember, however, that they have a regulatory responsibility (FAR 91.67(a)) to see and avoid other aircraft when weather conditions permit.

275. USE OF VISUAL CLEARING PROCEDURES

a. Before Takeoff. Prior to taxiing onto a runway or landing area in preparation for takeoff, pilots should scan the approach areas for possible landing traffic, executing appropriate clearing maneuvers to provide him a clear view of the approach areas.

b. Climbs and Descents. During climbs and descents in flight conditions which permit visual detection of other traffic, pilots should execute gentle banks, left and right at a frequency which permits continuous visual scanning of the airspace about them.

c. Straight and level. Sustained periods of straight and level flight in conditions which permit visual detection of other traffic should be broken at intervals with appropriate clearing procedures to provide effective visual scanning.

d. Traffic pattern. Entries into traffic patterns while descending create specific collision hazards and should be avoided.

e. Traffic at VOR sites. All operators should emphasize the need for sustained vigilance in the vicinity of VORs and airway intersections due to the convergence of traffic.

f. Training operations. Operators of pilot training programs are urged to adopt the following practices:

(1) Pilots undergoing flight instruction at all levels should be requested to verbalize clearing procedures (call out, "clear" left, right, above or below) to instill and sustain the habit of vigilance during maneuvering.

(2) High-wing airplane, momentarily raise the wing in the direction of the intended turn and look.

(3) Low-wing airplane, momentarily lower the wing in the direction of the intended turn and look.

(4) Appropriate clearing procedures should precede the execution of all turns including chandelles, lazy eights, stalls, slow flight, climbs, straight and level, spins and other combination maneuvers.

276—289. RESERVED

Section 5. PREFLIGHT

290. PREFLIGHT PREPARATION

a. Every pilot is urged to receive a preflight briefing and to file a flight plan. This briefing should consist of weather, airport, and en route NAVAID information. Briefing service may be obtained from a FSS either by telephone or interphone, by radio when airborne, or by a personal visit to the station.

b. For your convenience, you are urged to use the Flight Planner which is printed on FAA Form 8740-2. It provides a flight log, a reproduction of FAA Form 7233-1, Flight Plan, blocks to record weather and aeronautical data and a "go or no go" checklist. The Flight Planner and Flight Plan forms are available for use at all flight service stations. Additional copies will be provided on request.

c. Consult an FSS or Weather Service Office (WSO) for preflight weather briefing.

d. FSSs are required to advise of pertinent NOTAMs, but if they are overlooked, don't hesitate to remind the specialist that you have not received NOTAM information.

NOTE.— NOTAMS which are known in sufficient time for publication and are of 7 days duration or longer are normally incorporated into the Notices to Airmen (Class II) publication and carried there until cancellation time. FDC NOTAMs, which apply to instrument flight procedures, are also included in the Notices to Airmen publication up to and including the number indicated in the FDC NOTAM legend. Class II NOTAMs are not provided during a briefing unless specifically requested by the pilot since the FSS specialist has no way of knowing whether the pilot has already checked the Notices to Airmen (Class II) publication prior to calling. Remember to *ask* for Class II NOTAMs in the Notices to Airmen publication. This information is not normally furnished during your briefing. (See PARA—294 - NOTICE TO AIRMEN (NOTAM) SYSTEM.)

e. Pilots are urged to use only the latest issue of aeronautical charts in planning and conducting flight operations. Aeronautical charts are revised and reissued on a regular scheduled basis to ensure that depicted data are current and reliable. In the conterminous U.S., Sectional Charts are updated each 6 months, IFR En route Charts each 56 days, and amendments to civil IFR Approach Charts are accomplished on a 56 day cycle with a change notice volume issued on the 28 day midcycle. Charts that have been superseded by those of a more recent date may contain obsolete or incomplete flight information. (See PARA—623 - GENERAL DESCRIPTION OF EACH CHART SERIES.)

f. When requesting a preflight briefing, identify yourself as a pilot and provide the following:

(1) Type of flight planned, e.g., VFR or IFR.

(2) Aircraft number or pilot's name.

(3) Aircraft type.

(4) Departure Airport.

(5) Route of flight.

(6) Destination.

(7) Flight altitude(s).

(8) ETD and ETE.

g. Calls to air traffic control (ATC) facilities (ARTCCs, Towers, FSSs, Central Flow, and Communications Control Centers) over radio and ATC operational telephone lines (lines used for operational purposes such as controller instructions, briefings, opening and closing flight plans, issuance of IFR clearances and amendments, counter hijacking activities, etc.) may be monitored and recorded for operational uses such as accident investigations, accident prevention, search and rescue purposes, specialist training and evaluation, and technical evaluation and repair of control and communications system.

h. Prior to conducting a briefing, briefers are required to have the background information listed above so that they may tailor the briefing to the needs of the proposed flight. The objective is to communicate a "picture" of meteorological and aeronautical information necessary for the conduct of a safe and efficient flight. Briefers use all available weather and aeronautical information to summarize data applicable to the proposed flight. They do not read weather reports and forecasts verbatim unless specifically requested by the pilot. Refer to PARA—502 for those items of a weather briefing that should be expected or requested.

i. In addition to the filing of a flight plan, if the flight will traverse or land in one or more foreign countries, it is particularly important that pilots leave a complete itinerary with someone directly concerned, keep that person advised of the flight's progress and inform him that, if serious doubt arises as to the safety of the flight, he should first contact the FSS. (See PARA—300 - FLIGHTS OUTSIDE THE UNITED STATES AND U.S. TERRITORIES.)

j. Pilots operating under provisions of FAR—135, and not having an FAA assigned 3-letter designator, are urged to prefix the normal registration (N) number with the letter "T" on flight plan filing, (e.g., TN1234B). (See PARA—193 - AIRCRAFT CALL SIGNS.)

291. FOLLOW IFR PROCEDURES EVEN WHEN OPERATING VFR

a. To maintain IFR proficiency, pilots are urged to practice IFR procedures whenever possible, even when operating VFR. Some suggested practices include:

(1) Obtain a complete preflight and weather briefing. Check the NOTAMS.

(2) File a flight plan. This is an excellent low cost insurance policy. The cost is the time it takes to fill it out. The insurance includes the knowledge that someone will be looking for you if you become overdue at your destination.

(3) Use current charts.

(4) Use the navigation aids. Practice maintaining a good course—keep the needle centered.

(5) Maintain a constant altitude which is appropriate for the direction of flight.

(6) Estimate en route position times.

(7) Make accurate and frequent position reports to the FSSs along your route of flight.

b. Simulated IFR flight is recommended (under the hood); however, pilots are cautioned to review and adhere to the requirements specified in FAR—91.21 before and during such flight.

c. When flying VFR at night, in addition to the altitude appropriate for the direction of flight, pilots should maintain an altitude which is at or above the minimum en route altitude as shown on charts. This is especially true in mountainous terrain, where there is usually very little ground reference. Do not depend on your eyes alone to avoid rising unlighted terrain, or even lighted obstructions such as TV towers.

292—293. RESERVED

294. NOTICE TO AIRMEN (NOTAM) SYSTEM

a. Time-critical aeronautical information which is of either a temporary nature or is not sufficiently known in advance to permit publication on aeronautical charts or in other operational publications, receives immediate dissemination via the National Notice to Airmen (NOTAM) System.

NOTE.— NOTAM information is that aeronautical information that could affect a pilot's decision to make a flight. It includes such information as airport or primary runway closures, changes in the status of navigational aids, ILSs, radar service availability, and other information essential to planned enroute, terminal or landing operations.

b. NOTAM information is classified into three categories. These are NOTAM (D) or distant, NOTAM (L) or local, and Flight Data Center (FDC) NOTAMs.

(1) NOTAM (D)

(a) NOTAM (D) information is disseminated for all navigational facilities that are part of the National Airspace System (NAS), all IFR airports with approved IAPs, and for those VFR airports annotated with the Notam Service Symbol(§) in the Airport/Facility Directory (A/FD). The complete file of all NOTAM (D) information is maintained in a computer data base at the National Communications Center (NATCOM), located in Kansas City. This category of information is distributed automatically, appended to the hourly weather reports, via the Service A telecommunications system. Air traffic facilities, primarily FSS, with Service A capability, have access to the entire NATCOM data base of NOTAMs. These NOTAMs remain available via Service A for the duration of their validity or until published.

(2) NOTAM (L)

(a) NOTAM (L) information includes such data as taxiway closures, men and equipment near or crossing runways, airport rotating beacon outages, and airport lighting aids that do not affect instrument approach criteria, such as VASI. This category of NOTAM also contains all NOTAM information concerning airports that are not annotated with the Notam Service Symbol in the A/FD, including airport and runway closures.

(b) NOTAM (L) information is distributed locally only, and is not attached to the hourly weather reports. A separate file of local NOTAMs is maintained at each FSS, for facilities in their area only. NOTAM (L) information for other FSS areas must be specifically requested directly from the FSS that has responsibility for the airport concerned.

(3) FDC NOTAMS

(a) On those occasions when it becomes necessary to disseminate information which is requlatory in nature, the National Flight Data Center (NFDC), in Washington, D.C., will issue an FDC NOTAM. FDC NOTAMs contain such things as amendments to published IAPs and other current aeronautical charts. They are also used to advertise temporary flight restrictions caused by such things as natural disasters or large scale public events, that may generate a congestion of air traffic over a site.

(b) FDC NOTAMs are transmitted via Service A only once, and are kept on file at the FSS until published or cancelled. FSSs are responsible for maintaining a file of current, unpublished FDC NOTAMs concerning conditions within 400 miles of their facilities. FDC information concering conditions that are more than 400 miles from the FSS, or that is already published, is given to a pilot only on request.

c. An integral part of the NOTAM System is the biweekly Notice to Airmen (Class II) publication. Data is included in this publication to reduce congestion on the telecommunications circuits, and therefore is not available via Service A. This information once published, is not provided during pilot weather briefings unless specifically requested by the pilot.

NOTE.— The term "Class II" refers to the fact that the NOTAMs or notices, appear in printed form for mail distribution as opposed to NOTAMs which are distributed via telecommunications. The latter are considered Class I.

(1) This publication contains two sections:

(a) The first section consists of notices which meet the criteria for NOTAM (D), and are expected to remain in effect for an extended period, and FDC NOTAMs current at the time of publication. Occasionally, some NOTAM (L) and other unique information is included in this section when it will contribute to flight safety.

(b) The second section contains special notices that are too long or concern a wide or unspecified geographic area and are not suitable for inclusion in the first section. The content of these notices vary widely and there are no specific criteria for their inclusion, other than their enhancement of flight safety.

(c) The number of the last FDC NOTAM included in the publication, is noted on the first page to aid the user, in updating the listing contained, with any FDC NOTAMs which may have been issued between the cut-off date and the date the publication is received. All information contained will be carried until the information expires, is cancelled, or in the case of permanent conditions is published in other publications, such as the A/FD.

(d) All new notices entered, excluding FDC NOTAMs, will be published only if the information is expected to remain in effect for at least 7 days after the effective date of the publication.

295. FLIGHT PLAN — VFR FLIGHTS

a. Except for operations in or penetrating a Coastal Domestic ADIZ or DEWIZ (See PARA—430 - NATIONA SECURITY), a flight plan is not required for VFR fligh

However, it is strongly recommended that one be filed with an FAA FSS. This will ensure that you receive VFR Search and Rescue Protection. (Refer to PARA—456.f. for the proper method of filing.)

b. To obtain maximum benefits from the flight plan program, flight plans should be filed directly with the nearest FSS. For your convenience, FSSs provide aeronautical and meteorological briefings while accepting flight plans. Radio may be used to file if no other means are available.

NOTE.— Some states operate aeronautical communications facilities which will accept and forward flight plans to the FSS for further handling.

c. When a "stopover" flight is anticipated, it is recommended that a separate flight plan be filed for each "leg" when the stop is expected to be more than 1 hour duration.

d. Pilots are encouraged to give their departure times directly to the FSS serving the departure airport or as otherwise indicated by the FSS when the flight plan is filed. This will ensure more efficient flight plan service and permit the FSS to advise you of significant changes in aeronautical facilities or meteorological conditions. When a VFR flight plan is filed, it will be held by the FSS until 1 hour after the proposed departure time unless:

(1) The actual departure time is received.

(2) A revised proposed departure time is received.

(3) At a time of filing, the FSS is informed that the proposed departure time will be met, but actual time cannot be given because of inadequate communications (assumed departures).

e. On pilot's request, at a location having an active tower, the aircraft identification will be forwarded by the FSS to the tower for reporting the actual departure time. This procedure should be avoided at busy airports.

f. Although position reports are not required for VFR flight plans, periodic reports to FAA, FSSs along the route are good practice. Such contacts permit significant information to be passed to the transiting aircraft and also serve to check the progress of the flight should it be necessary for any reason to locate the aircraft.

EXAMPLE:

BONANZA 314K, OVER KINGFISHER AT (Time), VFR FLIGHT PLAN, TULSA TO AMARILLO.

EXAMPLE:

CHEROKEE 5133J, OVER OKLAHOMA CITY AT (Time), SHREVEPORT TO DENVER, NO FLIGHT PLAN.

g. Pilots not operating on an IFR flight plan, and when in level cruising flight, are cautioned to conform with VFR cruising altitudes appropriate to direction of flight.

h. Indicate aircraft equipment capabilities when filing VFR flight plans by appending the appropriate suffix to aircraft type in the same manner as that prescribed for IFR flight (see PARA—298 — FLIGHT PLAN - IFR FLIGHTS). Under some circumstances, ATC computer tapes can be useful in constructing the radar history of a downed or crashed aircraft. In each case, knowledge of the aircraft's transponder equipment is necessary in determining whether or not such computer tapes might prove effective.

296. FLIGHT PLAN — DEFENSE VFR (DVFR) FLIGHTS

VFR flights into a Coastal or Domestic ADIZ/DEWIZ are required to file a VFR flight plan for security purposes. Detailed ADIZ procedures are found in the National Security section of this chapter. (See FAR—99.)

297. COMPOSITE FLIGHT PLAN (VFR/IFR FLIGHTS)

a. Flight plans which specify VFR operation for one portion of a flight, and IFR for another portion, will be accepted by the FSS at the point of departure. If VFR flight is conducted for the first portion of the flight, the pilot should report his departure time to the FSS with which he filed his VFR/IFR flight plan; and, subsequently, close the VFR portion and request ATC clearance from the FSS nearest the point at which change from VFR to IFR is proposed. Regardless of the type facility you are communicating with (FSS, center, or tower), it is the pilot's responsibility to request that facility to "CLOSE VFR FLIGHT PLAN." The pilot must remain in VFR weather conditions until operating in accordance with the IFR clearance.

b. When a flight plan indicates IFR for the first portion of flight and VFR for the latter portion, the pilot will normally be cleared to the point at which the change is proposed. Once the pilot has reported over the clearance limit and does not desire further IFR clearance, he should advise ATC to cancel the IFR portion of his flight plan. Further clearance will not be necessary for VFR flight beyond that point. If the pilot desires to continue his IFR flight plan beyond the clearance limit, he should contact ATC at least 5 minutes prior to the clearance limit and request further IFR clearance. If the requested clearance is not received prior to reaching the clearance limit fix, the pilot will be expected to established himself in a standard holding pattern on the radial or course to the fix unless a holding pattern for the clearance limit fix is depicted on a U.S. Government or commercially produced (meeting FAA requirements) Low or High Altitude En Route, Area or STAR Chart. In this case the pilot will hold according to the depicted pattern.

298. FLIGHT PLAN — IFR FLIGHTS

a. GENERAL

(1) Prior to departure from within, or prior to entering controlled airspace, a pilot must submit a complete flight plan and receive an air traffic clearance, if weather conditions are below VFR minimums. Instrument flight plans may be submitted to the nearest FSSs or ATCT either in person or by telephone (or by radio if no other means are available). Pilots should file IFR flight plans at least 30 minutes prior to estimated time of departure to preclude possible delay in receiving a departure clearance from ATC. To minimize your delay in entering the control zone at destination when IFR weather conditions exist or are forecast at that airport, an IFR flight plan should be filed before departure. Otherwise, a 30 minute delay is not unusual in receiving an ATC clearance because of time spent in processing flight plan data. Traffic saturation frequently prevents control personnel from accepting flight plans by radio. In such cases, the pilot is advised to contact the nearest FSS for the purpose of filing the flight plan.

NOTE.— There are several methods of obtaining IFR clearances at nontower, non-FSSs, and outlying airports. The procedure may vary due to geographical features, weather conditions, and the complexity of the ATC system. To determine the most effective means of receiving an IFR clearance, pilots should ask the nearest FSS the most appropriate means of obtaining the IFR clearance.

(2) When filing an IFR flight plan for a Heavy aircraft, add the prefix H to the aircraft type.

EXAMPLE:

H/DC10/U

(3) When filing an IFR flight plan for flight in an aircraft equipped with a radar beacon transponder, DME equipment, TACAN only equipment or a combination of both, identify equipment capability by adding a suffix to the AIRCRAFT TYPE preceded by a slant, as follows:

/X — no transponder.

/T — transponder with no altitude encoding capability.

/U — transponder with altitude encoding capability.

/D — DME, but no transponder.

/B — DME and transponder, but no altitude encoding capability.

/A — DME and transponder with altitude encoding capability.

/M — TACAN only, but no transponder.

/N — TACAN only and transponder, but with no altitude encoding capability.

/P — TACAN only and transponder with altitude encoding capability.

/C — RNAV and transponder, but with no altitude encoding capability.

/R — RNAV and transponder with altitude encoding capability.

/W — RNAV but no transponder.

(4) It is recommended that pilots file the maximum transponder or navigation capability of their aircraft in the equipment suffix. This will provide ATC with the necessary information to utilize all facets of navigational equipment and transponder capabilities available. In the case of area navigation equipped aircraft, pilots should file the /C, /R, or /W capability of the aircraft even though an RNAV route or random RNAV route has not been requested. This will ensure ATC awareness of the pilot's ability to navigate point-to-point and may be utilized to expedite the flight.

NOTE.— The suffix is not to be added to the aircraft identification or be transmitted by radio as part of the aircraft identification.

b. AIRWAYS/JET ROUTES DEPICTION ON FLIGHT PLAN

(1) It is vitally important that the route of flight be accurately and completely described in the flight plan. To simplify definition of the proposed route, and to facilitate ATC, pilots are requested to file via airways or jet routes established for use at the altitude or flight level planned.

(2) If flight is to be conducted via designated airways or jet routes, describe the route by indicating the type and number designators of the airway(s) or jet route(s) requested. If more than one airway or jet route is to be used, clearly indicate points of transition. If the transition is made at an unnamed intersection, show the next succe
NAVAID or named intersection on the intended route
the complete route from that point. Reporting points
be identified by using authorized name/code as depicted
appropriate aeronautical charts. The following two ex
ples illustrate the need to specifiy the transition p
when two routes share more than one transition fix.

EXAMPLE:

FL 250 ALB J37 BUMPY J14 BHM

SPELLED OUT: Requesting Flight Level 250 fr
Albany, New York, via Jet Route 37 transitioning to
Route 14 at BUMPY intersection, thence via Jet Route
to Birmingham, Alabama.

EXAMPLE:

FL 250 ALB J37 ENO J14 BHM

SPELLED OUT: Requesting Flight Level 250 fr
Albany, New York, via Jet Route 37 transitioning to
Route 14 at Kenton VORTAC (ENO) thence via Jet Ro
14 to Birmingham, Alabama.

(a) The route of flight may also be described
naming the reporting points or NAVAIDs over which
flight will pass, provided the points named are establis
for use at the altitude or flight level planned.

EXAMPLE:

30 BWI V44 SWANN V433 DQO

SPELLED OUT: Requesting 3,000 feet from Baltim
Washington International, via Victor 44 To Swann In
section, transitioning to Victor 433 at Swann, thence
V433 to Dupont.

(b) When the route of flight is defined by na
reporting points, whether alone or in combination with
ways or jet routes, and the navigational aids (V
VORTAC, TACAN, NDB) to be used for the flight ar
combination of different types of aids, enough informa
should be included to clearly indicate the route reques

EXAMPLE:

FL 310 LAX J5 LKV J3 GEG YXC FL 330 HL500
HL515 YWG

SPELLED OUT: Requesting FL 310 from Los An
International via Jet Route 5 Lakeview, Jet Route 3
kane, direct Kimberly, British Columbia Low Frequ
Range, Flight Level 330 High Level Airway 500 to L
gruth, Manitoba VOR, High Level Airway 515 to Wi
peg, Manitoba.

(c) When filing IFR, it is to the pilot's advanta
file a preferred route.

NOTE.— Preferred IFR routes are described and tabula
the Airport/Facility Directory.

(d) ATC may issue a SID or a STAR, as appr
ate. (See PARA—325 - INSTRUMENT DEPARTURE
PARA—360 - STANDARD TERMINAL ARRIVAL (STA

NOTE.— Pilots not desiring a SID or STAR should so in
in the remarks section of the flight plan as "NO SID" or
STAR".

c. DIRECT FLIGHTS

(1) All or any portions of the route which will n
flown on the radials or courses of established airwa
routes, such as direct route flights, must be defined by
cating the radio fixes over which the flight will pass.
selected to define the route shall be those over which

ition of the aircraft can be accurately determined. Such es automatically become compulsory reporting points for flight, unless advised otherwise by ATC. Only those vigational aids established for use in a particular struc- e, i.e., in the low or high structures, may be used to fine the en route phase of a direct flight within that alti- de structure.

(2) The azimuth feature of VOR aids and that azi- ath and distance (DME) features of VORTAC and ACAN aids are assigned certain frequency protected eas of airspace which are intended for application to es- blished airway and route use, and to provide guidance for anning flights outside of established airways or routes. ese areas of airspace are expressed in terms of cylindri- l service volumes of specified dimensions called "class nits" or "categories." (See PARA—10 - CLASS OF AVAIDs.) An operational service volume has been estab- hed for each class in which adequate signal coverage and equency protection can be assured. To facilitate use of OR, VORTAC or TACAN aids, consistent with their oper- ional service volume limits, pilot use of such aids for de- ning a direct route of flight in controlled airspace should t exceed the following:

(a) Operations above FL 450 — use aids not more an 200 NM apart. These aids are depicted on En Route igh Altitude Charts.

(b) Operation off established routes from 18,000 et MSL to FL 450 - use aids not more than 260 NM apart. hese aids are depicted on En Route High Altitude Charts.

(c) Operation off established airways below 18,000 et MSL — use aids not more than 80 NM apart. These ds are depicted on En Route Low Altitude Charts.

(d) Operation off established airways between ,500 feet MSL and 17,999 feet MSL in the conterminous S. — (H) facilities not more than 200 NM apart may be ed.

(3) Increasing use of self-contained airborne naviga- onal systems which do not rely on the VOR/VORTAC/ ACAN system has resulted in pilot requests for direct utes which exceed NAVAID service volume limits. These ect route requests will be approved only in a radar envi- nment, with approval based on pilot responsibility for vigation on the authorized direct route. Radar flight fol- wing will be provided by ATC for ATC purposes.

(4) At times, ATC will initiate a direct route in a dar environment which exceeds NAVAID service volume mits. In such cases ATC will provide radar monitoring d navigational assistance as necessary.

(5) Airway or jet route numbers, appropriate to the ratum in which operation will be conducted, may also be cluded to describe portions of the route to be flown.

EXAMPLE:

140 MDW V262 BDF V10 BRL STJ SLN GCK

SPELLED OUT: Requesting 14,000 feet from Chicago dway Airport via Victor 262 to Bradford, Victor 10 to rlington, Iowa, direct St. Joseph, Missouri, direct Salina, nsas, direct Garden City, Kansas.

NOTE.— When route of flight is described by radio fixes, the lot will be expected to fly a direct course between the points med.

(6) Pilots are reminded that they are responsible for hering to obstruction clearance requirements on those segments of direct routes that are outside of controlled airspace. The MEA's and other altitudes shown on Low Altitude IFR En Route Charts pertain to those route segments within controlled airspace, and those altitudes may not meet obstruction clearance criteria when operating off those routes.

d. AREA NAVIGATION (RNAV) ROUTES

(1) Except for a few high altitude Alaskan routes, there is no longer a U.S. RNAV route system. Pilots of aircraft equipped with operational area navigation avionics may file for random RNAV routes throughout the National Airspace System where radar monitoring by ATC is available.

(2) The complexities involved in determining route width, with reference to facility usable distance, requires that random RNAV routes only be approved in a radar environment. ATC will radar monitor each flight, however, navigation on the random RNAV route is the responsibility of the pilot. Factors that will be considered by ATC in approving random RNAV routes, include the capability to provide radar monitoring and compatibility with traffic volume and flow.

(3) Pilots requesting ATC clearance for random RNAV routes based on navigational aids are expected to do the following:

(a) File airport to airport flight plans prior to departure.

(b) File the appropriate RNAV capability certification suffix in the flight plan.

(c) Plan the random route portion of the flight plan to begin and end over appropriate arrival and departure transition fixes or appropriate navigation aids for the altitude stratum within which the flight will be conducted.

(d) File route structure transitions to and from the random route portion in the flight plan. The use of normal preferred departure and arrival routes, such as SID and STAR where established, is recommended.

(e) Define random routes by waypoints. File route description waypoints by using degree-distance in reference to navigation aids for the appropriate altitude stratum.

(f) File a minimum of one route description waypoint for each ARTCC's area over which the random portion of flight will be conducted. Such waypoints must be located within 200 NM of the boundary of the preceding centers flight advisory area.

(g) File an additional route description waypoint for each turnpoint in the route.

(h) Though not required in the flight plan, plan additional waypoints necessary to ensure accurate navigation via the filed route of flight. Navigation is the pilot's responsibility unless ATC assistance is requested.

(i) Plan the route of flight so as to avoid Prohibited and Restricted Airspace unless pilots have obtained permission to operate in that airspace and so informs the appropriate ATC facility. Avoid flight planning through other uncontrolled airspace unless specifically desiring flight through such airspace.

(4) Pilots requesting ATC clearance for random RNAV routes based on latitude/longitude coordinates are expected to do the following:

(a) File airport to airport flight plans prior to departure.

(b) File the appropriate RNAV capability certification suffix in the flight plan.

(c) Plan the random route portion of the flight to begin and end over published departure/arrival transition fixes or appropriate navigation aids for airports without published transition procedures. The use of preferred departure and arrival routes, such as SID and STAR where established, is recommended.

(d) Plan the route of flight so as to avoid prohibited and restricted airspace by 3 NM unless permission has been obtained to operate in that airspace and the appropriate ATC facility is advised.

(e) Define the route of flight after the departure fix, including each intermediate fix (turnpoint) and the arrival fix for the destination airport in terms of latitude/longitude coordinates plotted to the nearest minute. The arrival fix must be identified by both the latitude/longitude coordinates and a fix identifier.

Example:

MIA [1] SRQ [2] 3407/10615 [3] 3407/11546 TNP [4] LAX [5]

1. Departure airport.
2. Departure fix.
3. Intermediate fix (turning point).
4. Arrival fix.
5. Destination airport.

(f) Record latitude/longitude coordinates by four figures describing latitude in degrees and minutes followed by a solidus and five figures describing longitude in degrees and minutes.

(g) File at FL 390 or above for the random RNAV portion of the flight.

(h) Fly all routes/route segments on Great Circle tracks.

(i) Make any inflight requests for random RNAV clearances or route amendments to an en route ATC facility.

(5) To be certified for use in the National Airspace System, RNAV equipment must meet the specifications outline in AC 90-45. The pilot is responsible for variations in equipment capability, and must advise ATC if he cannot accept an RNAV clearance as specified. The controller need only be concerned that the aircraft is RNAV equipped. If the flight plan equipment suffix denotes RNAV capability, then RNAV routing can be applied.

299. IFR OPERATIONS TO HIGH ALTITUDE DESTINATIONS

a. Pilots planning IFR flights to airports located in mountainous terrain are cautioned to consider the necessity for an alternate airport even when the forecast weather conditions would technically relieve them from the requirement to file one (Reference: FAR—91.23(b)). The FAA has identified three possible situations where the failure to plan for an alternate airport when flying IFR to such a destination airport could result in a critical situation if the weather is less than forecast and sufficient fuel is not available to proceed to a suitable airport.

(1) An IFR flight to an airport where the MDAs
landing visibility minimums for *ALL INSTRUMENT*
PROACHES are higher than the forecast weather
mums specified in FAR—91.23(b). For example, there
10 high altitude airports in the United States with
proved instrument approach procedures where all of
Minimum Descent Altitudes (MDAs) are greater than
feet and/or the landing visibility minimums are gre
than 3 miles (Bishop, California; South Lake Tahoe, C
fornia; Ukiah, California; Butte, Montana; Helena, M
tana; Missoula, Montana; Chadron, Nebraska; Ely, Nev
Klamath Falls, Oregon; and Omak, Washington). In
case of these 10 airports, it is possible for a pilot to
on the basis of forecasts, not to carry sufficient fuel to
to an alternate when the ceiling and/or visibility is act
ly lower than that necessary to complete the approach.

(2) A small number of other airports in mountain
terrain have MDAs which are slightly (100 to 300
below 2000 feet AGL. In situations where there is an op
as to whether to plan for an alternate, pilots should be
mind that just a slight worsening of the weather condi
from those forecast could place the airport below the
lished IFR landing minimums.

(3) An IFR flight to an airport which requires sp
equipment, i.e., DME, glide slope, etc., in order to mak
available approaches to the lowest minimums.
should be aware that all other minimums on the app
charts may require weather conditions better than
specified in FAR—91.23(b). An inflight equipment mal
tion could result in the inability to comply with the
lished approach procedures or, again, in the positi
having the airport below the published IFR landing
mums for all remaining instrument approach altern

300. FLIGHTS OUTSIDE THE UNITED STATES
U.S. TERRITORIES

a. When conducting flights, particularly ex
flights, outside the U.S. and its territories, full
should be taken of the amount and quality of air
tion services available in the airspace to be tra
Every effort should be made to secure information
location and range of navigational aids, availability
munications and meterological services, the provisio
traffic services, including alerting service, and the
ence of search and rescue services.

b. The filing of a flight plan, always good
takes on added significance for extended flights
U.S. airspace and is, in fact, usually required by t
of the countries being visited or overflown. It is a
ticularly important in the case of such flights tha
leave a complete itinerary and schedule of the flig
someone directly concerned, keep that person ad
the flight's progress and inform him that if seriou
arises as to the safety of the flight he should first
the appropriate FSS.

c. All pilots should review the foreign airsp
entry restrictions published in the IFIM during t
planning process. Foreign airspace penetration wi
ficial authorization can involve both danger to the
and the imposition of severe penalties and inconve
both passengers and crew. A flight plan on file w
authorities does not necessarily constitute the prio

sion required by certain other authorities. The possibility of fatal consequences cannot be ignored in some areas of the world.

d. Current NOTAMs for foreign locations must also be reviewed. The publication International Notices to Airmen, published biweekly, contains considerable information pertinent to foreign flight. Current foreign NOTAMs are also available from the U.S. International NOTAM Office in Washington, D.C., through any local FSS.

e. When customs notification is required, it is the responsibility of the pilot to arrange for customs notification in a timely manner. The following guidelines are applicable:

(1) When customs notification is required on flights to Canada and Mexico and a predeparture flight plan cannot be filed or an advise customs message (ADCUS) cannot be included in a predeparture flight plan, call the nearest en route domestic or International FSS as soon as radio communication can be established and file a VFR or DVFR flight plan, as required, and include as the last item the advise customs information. The station with which such a flight plan is filed will forward it to the appropriate FSS who will notify the customs office responsible for the destination airport.

(2) If the pilot fails to include ADCUS in the radioed flight plan, it will be assumed that other arrangements have been made and FAA will not advise customs.

(3) The FAA assumes no responsibility for any delays in advising customs if the flight plan is given too late for delivery to customs before arrival of the aircraft. It is still the pilot's responsibility to give timely notice even though a flight plan is given to FAA.

301. CHANGE IN FLIGHT PLAN

In addition to altitude or flight level, destination and/or route changes, increasing or decreasing the speed of an aircraft constitutes a change in a flight plan. Therefore, at any time the average true airspeed at cruising altitude between reporting points varies or is expected to vary from that given in the flight plan by *plus or minus 5 percent, or 10 knots, whichever is greater,* ATC should be advised.

302. CHANGE IN PROPOSED DEPARTURE TIME

a. To prevent computer saturation in the en route environment, parameters have been established to delete proposed departure flight plans which have not been activated. Most centers have this parameter set so as to delete these flight plans a minimum of 1 hour after the proposed departure time. To ensure that a flight plan remains active, pilots whose actual departure time will be delayed 1 hour or more beyond their filed departure time, are requested to notify ATC of their departure time.

b. Due to traffic saturation, control personnel frequently will be unable to accept these revisions via radio. It is recommended that you forward these revisions to the nearest FSS.

303. CLOSING VFR/DVFR FLIGHT PLANS

A pilot is responsible for ensuring that his VFR or DVFR flight plan is cancelled (FAR—91.83). You should close your flight plan with the nearest FSS, or if one is not available, you may request any ATC facility to relay your cancellation to the FSS. *Control towers do not automatically close VFR or DVFR flight plans* since they do not know if a particular VFR aircraft is on a flight plan. If you fail to report or cancel your flight plan within 1/2 hour after your ETA, Search and Rescue procedures are started.

304. CANCELLING IFR FLIGHT PLAN

a. FAR—91.83 includes the statement "When a flight plan has been filed, the pilot in command, upon cancelling or completing the flight under the flight plan, shall notify the nearest FSS or ATC facility."

b. An IFR flight plan may be cancelled at any time the flight is operating in VFR conditions outside positive controlled airspace by the pilot stating "CANCEL MY IFR FLIGHT PLAN" to the controller or air/ground station with which he is communicating. Immediately after cancelling an IFR flight plan, a pilot should take necessary action to change to the appropriate air/ground frequency, VFR radar beacon code and VFR altitude or flight level.

c. ATC separation and information services will be discontinued, including radar services (where applicable). Consequently, if the cancelling flight desires VFR radar advisory service, the pilot must specifically request it.

NOTE.— Pilots must be aware that other procedures may be applicable to a flight that cancels an IFR flight plan within an area where a special program has been established such as a designated TRSA or TCA.

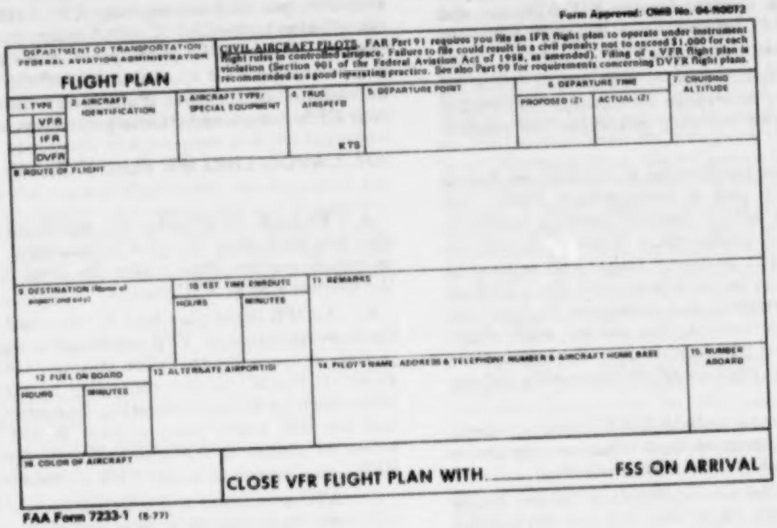
d. If a DVFR flight plan requirement exists, the pilot is responsible for filing this flight plan to replace the cancelled IFR flight plan. If a subsequent IFR operation becomes necessary, a new IFR flight plan must be filed and an ATC clearance obtained before operating in IFR conditions.

e. If operating on an IFR flight plan to an airport with a functioning control tower, the flight plan is automatically closed upon landing.

f. If operating on an IFR flight plan to an airport where there is no functioning control tower, the pilot must initiate cancellation of the IFR flight plan. This can be done after landing if there is a functioning FSS or other means of direct communications with ATC. In the event there is no FSS and air/ground communications with ATC is not possible below a certain altitude, the pilot should, weather conditions permitting, cancel his IFR flight plan while still airborne and able to communicate with ATC by radio. This will not only save the time and expense of cancelling the flight plan by telephone but will quickly release the airspace for use by other aircraft.

305. GENERAL INSTRUCTIONS FOR THE FAA FLIGHT PLAN FORM

a. Flight Plan Form.



Form Approved: OMB No. 04-R0072

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
FLIGHT PLAN

CIVIL AIRCRAFT PILOTS. FAR Part 91 requires you file an IFR flight plan to operate under instrument flight rules in controlled airspace. Failure to file could result in a civil penalty not to exceed $1,000 for each violation (Section 901 of the Federal Aviation Act of 1958, as amended). Filing of a VFR flight plan is recommended as a good operating practice. See also Part 99 for requirements concerning DVFR flight plans.

1. TYPE ☐ VFR ☐ IFR ☐ DVFR
2. AIRCRAFT IDENTIFICATION
3. AIRCRAFT TYPE/ SPECIAL EQUIPMENT
4. TRUE AIRSPEED KTS
5. DEPARTURE POINT
6. DEPARTURE TIME PROPOSED (Z) ACTUAL (Z)
7. CRUISING ALTITUDE
8. ROUTE OF FLIGHT
9. DESTINATION (Name of airport and city)
10. EST. TIME ENROUTE HOURS MINUTES
11. REMARKS
12. FUEL ON BOARD HOURS MINUTES
13. ALTERNATE AIRPORT(S)
14. PILOT'S NAME, ADDRESS & TELEPHONE NUMBER & AIRCRAFT HOME BASE
15. NUMBER ABOARD
16. COLOR OF AIRCRAFT

CLOSE VFR FLIGHT PLAN WITH ____________ FSS ON ARRIVAL

FAA Form 7233-1 (8-77)

b. Explanation of Flight Plan Items.

Block 1. Check the type flight plan. Check both the VFR and IFR blocks if composite VFR/IFR.

Block 2. Enter your complete aircraft identification including the prefix "N" if applicable.

Block 3. Enter the designator for the aircraft or, if unknown, the aircraft manufacturer's name (e.g., Cessna); followed by a slant(/) and the transponder or DME equipment code letter (e.g., C-182/U).

Block 4. Enter your computed true airspeed (TAS).

NOTE.— If IFR and the average TAS changes plus or minus 5 percent or 10 knots, whichever is greater, advise ATC.

Block 5. Enter the departure airport identifier code (or the name if identifier is unknown).

NOTE.— Use of identifier codes will expedite the processing of your flight plan.

Block 6. Enter the proposed departure time in Coordinated Universal Time (UTC) (Z). If airborne, specify the actual or proposed departure time as appropriate.

Block 7. If VFR, enter the appropriate VFR altitude (to assist the briefer in providing weather and wind information) and, if IFR, enter the requested en route altitude or flight level.

NOTE.— Enter only the initial requested altitude in this block. When more than one IFR altitude or flight level is desired along the route of flight, it is best to make a subsequent request direct to the controller.

Block 8. Define the route of flight by using NAVAID identifier codes (or names if the code is unknown), airways, jet routes, and waypoints (for RNAV).

NOTE.— Use NAVAIDs or WAYPOINTs to define direct ro and radials/bearings to define other unpublished routes.

Block 9. Enter the destination airport identifier o (or name if identifier is unknown).

NOTE.— Include the city name (or even the state nam needed for clarity.

Block 10. Enter your estimated time en route b on latest forecast winds.

Block 11. Enter only those remarks pertinent to A or to the clarification of other flight plan information s as the appropriate radiotelephony (call sign) associ with the designator filed in Block 2. Items of a pers nature are not accepted. Do not assume that remarks be automatically transmitted to every controller. Spe ATC or en route requests should be made directly to appropriate controller.

Block 12. Specify the fuel on board computed f the departure point.

Block 13. Specify an alternate airport if desire required, but do not include routing to the alternate port.

Block 14. Enter your complete name, address, telephone number. Enter sufficient information to ide home base, airport, or operator.

NOTE.— This information would be essential in the ev search and rescue operation.

Block 15. Enter the total number of persons on b including crew.

Block 16. Enter the predominant colors.

Last Block. For VFR flight plans, record the FSS ame for closing the flight plan. If the flight plan is closed vith a different FSS or facility, state the recorded FSS ame that would normally have closed your flight plan.

NOTE.— Close IFR flight plans with tower, approach control, r ARTCCs, or if unable, with FSS. When landing at an airport vith a functioning control tower, IFR flight plans are automatical- y cancelled.

c. The information transmitted to the destination FSS or VFR Flight Plans will consist only of flight plans blocks 2,3,9, and 10. Estimated time en route (ETE) will be converted to the correct estimated time of arrival (ETA) for VFR flight plans.

d. The information transmitted to the ARTCC for IFR Flight Plans will consist of only flight plan blocks 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11.

e. A description of the International Flight Plan Form is contained in the International Flight Information Manual.

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NOTES

Section 6. DEPARTURE PROCEDURES

20. PRE-TAXI CLEARANCE PROCEDURES

a. Certain airports have established Pre-taxi Clearance rograms whereby pilots of departing IFR aircraft may ect to receive their IFR clearances before they start taxi-g for takeoff. The following provisions are included in ch procedures:

(1) Pilot participation is not mandatory.

(2) Participating pilots call clearance delivery or round control not more than 10 minutes before proposed axi time.

(3) IFR clearance (or delay information, if clearance annot be obtained) is issued at the time of this initial call-p.

(4) When the IFR clearance is received on clearance elivery frequency, pilots call ground control when ready o taxi.

(5) Normally, pilots need not inform ground control hat they have received IFR clearance on clearance deliv-ry frequency. Certain locations may, however, require hat the pilot inform ground control of a portion of his outing or that he has received his IFR clearance.

(6) If a pilot cannot establish contact on clearance de-ivery frequency or has not received his IFR clearance efore he is ready to taxi, he contacts ground control and nforms the controller accordingly.

b. Locations where these procedures are in effect are ndicated in the Airport/Facility Directory.

321. TAXI CLEARANCE

Pilots on IFR flight plans should communicate with the ontrol tower on the appropriate ground control or clearance delivery frequency, prior to starting engines, to receive engine start time, taxi and/or clearance information.

322. ABBREVIATED IFR DEPARTURE CLEARANCE (CLEARED...AS FILED) PROCEDURES

a. ATC facilities will issue an abbreviated IFR departure clearance based on the ROUTE of flight filed in the IFR flight plan, provided the filed route can be approved with little or no revision. These abbreviated clearance procedures are based on the following conditions:

(1) The aircraft is on the ground or it has departed VFR and the pilot is requesting IFR clearance while airborne.

(2) That a pilot will not accept an abbreviated clearance if the route or destination of a flight plan filed with ATC has been changed by him or the company or the operations officer before departure.

(3) That it is the responsibility of the company or operations office to inform the pilot when they make a change to the filed flight plan.

(4) That it is the responsibility of the pilot to inform ATC in his initial call-up (for clearance) when the filed flight plan has been either:

(a) amended, or

(b) cancelled and replaced with a new filed flight plan.

NOTE.— The facility issuing a clearance may not have received the revised route or the revised flight plan by the time a pilot requests clearance.

b. The controller will issue a detailed clearance when he knows that the original filed flight plan has been changed or when the pilot requests a full route clearance.

c. The clearance as issued will include the destination airport filed in the flight plan.

d. ATC procedures now require the controller to state the SID name, the current number and the SID Transition name after the phrase "Cleared to (destination) airport" and prior to the phrase, "then as filed," for ALL departure clearances when the SID or SID Transition is to be flown. The procedures apply whether or not the SID is filed in the flight plan.

e. STARs, when filed in a flight plan, are considered a part of the filed route of flight and will not normally be stated in an initial departure clearance. If the ARTCC's jurisdictional airspace includes both the departure airport and the fix where a STAR or STAR Transition begins, the STAR name, the current number and the STAR Transition name MAY be stated in the initial clearance.

f. "Cleared to (destination) airport as filed" does NOT include the en route altitude filed in a flight plan. An en route altitude will be stated in the clearance or the pilot will be advised to expect an assigned or filed altitude within a given time frame or at a certain point after departure. This may be done verbally in the departure instructions or stated in the SID.

g. In both radar and nonradar environments, the controller will state "Cleared to (destination) airport as filed" or:

(1) If a SID or SID Transition is to be flown, specify the SID name, the current SID number, the SID Transition name, the assigned altitude/flight level, and any additional instructions (departure control frequency, beacon code assignment, etc.) necessary to clear a departing aircraft via the SID or SID Transition and the route filed.

EXAMPLE:

NATIONAL SEVEN TWENTY CLEARED TO MIAMI AIRPORT INTERCONTINENTAL ONE DEPARTURE, LAKE CHARLES TRANSITION THEN AS FILED, MAINTAIN FLIGHT LEVEL TWO SEVEN ZERO.

(2) When there is no SID or when the pilot cannot accept a SID, the controller will specify the assigned altitude or flight level, and any additional instructions necessary to clear a departing aircraft via an appropriate departure routing and the route filed.

NOTE.— A detailed departure route description or a radar vector may be used to achieve the desired departure routing.

(3) If it is necessary to make a minor revision to the filed route, the controller will specify the assigned SID or SID Transition (or departure routing), the revision to the filed route, the assigned altitude or flight level and any additional instructions necessary to clear a departing aircraft.

EXAMPLE:

JET STAR ONE FOUR TWO FOUR CLEARED TO ATLANTA AIRPORT, SOUTH BOSTON TWO DEPARTURE THEN AS FILED EXCEPT CHANGE ROUTE TO READ SOUTH BOSTON VICTOR 20 GREENSBORO, MAINTAIN ONE SEVEN THOUSAND.

(4) Additionally, in a nonradar environment, the controller will specify one or more fixes, as necessary, to identify the initial route of flight.

EXAMPLE:

CESSNA THREE ONE SIX ZERO FOXTROT CLEARED TO CHARLOTTE AIRPORT AS FILED VIA BROOKE, MAINTAIN SEVEN THOUSAND.

h. To ensure success of the program, pilots should:

(1) Avoid making changes to a filed flight plan just prior to departure.

(2) State the following information in the initial call-up to the facility when no change has been made to the filed flight plan: Aircraft call sign, location, type operation (IFR) and the name of the airport (or fix) to which you expect clearance.

EXAMPLE:

"WASHINGTON CLEARANCE DELIVERY (or ground control if appropriate) AMERICAN SEVENTY SIX AT GATE ONE, IFR LOS ANGELES."

(3) If the flight plan has been changed, state the change and request a full route clearance.

EXAMPLE:

"WASHINGTON CLEARANCE DELIVERY, AMERICAN SEVENTY SIX AT GATE ONE. IFR SAN FRANCISCO. MY FLIGHT PLAN ROUTE HAS BEEN AMENDED (or destination changed). REQUEST FULL ROUTE CLEARANCE."

(4) Request verification or clarification from ATC if ANY portion of the clearance is not clearly understood.

(5) When requesting clearance for the IFR portion of a VFR/IFR flight, request such clearance prior to the fix where IFR operation is proposed to commence in sufficient time to avoid delay. Use the following phraseology:

EXAMPLE:

"LOS ANGELES CENTER, APACHE SIX ONE PAPA, VFR ESTIMATING PASO ROBLES VOR AT THREE TWO, ONE THOUSAND FIVE HUNDRED, REQUEST IFR TO BAKERSFIELD."

323. CLEARANCE VOID TIMES

a. If operating from an airport not served by a control tower, the pilot may receive a clearance containing a provision that if the flight has not departed by a specific time, the clearance is void. In this situation, the pilot who does not depart prior to the void time must advise ATC as as possible, but no later than 30 minutes, of his intentio

b. Failure to take this action can result in costly del and reroutes of other IFR traffic because ATC will ta action on the assumption that the pilot departed cleared. Additionally, extensive search and rescue op ations may be initiated if nothing is heard from the pi after he accepts the ATC clearance.

EXAMPLE:

CLEARANCE VOID IF NOT OFF BY (time). IF N OFF BY (clearance void time) ADVISE (facility) N LATER THAN (time) OF INTENTIONS.

324. DEPARTURE CONTROL

a. Departure Control is an approach control func responsible for ensuring separation between departures as to expedite the handling of departures. Departure C trol may suggest a take off direction other than that wh may normally have been used under VFR handling. Ma times it is preferred to offer the pilot a runway that require the fewest turns after take off to place the pilo his filed course or selected departure route as quickly possible. At many locations particular attention is pai the use of preferential runways for local noise abatem programs, and route departures away from cong areas.

b. Departure Control utilizing radar will normally aircraft out of the terminal area using SIDs via radio gation aids. When a departure is to be vectored immed ly following take off, the pilot will be advised prior to off of the initial heading to be flown but may not b vised of the purpose of the heading. Pilots operating radar environment are expected to associate depa headings with vectors to their planned route or f When given a vector taking his aircraft off a previous signed nonradar route, the pilot will be advised b what the vector is to achieve. Thereafter, radar servic be provided until the aircraft has been reestablished course" using an appropriate navigation aid and the has been advised of his position or a handoff is made other radar controller with further surveillance ca ties.

c. Controllers will inform pilots of the departur trol frequencies and, if appropriate, the transponder before takeoff. Pilots should not operate their transp until ready to start the takooff roll or change to the ture control frequency until requested. Controllers omit the departure control frequency if a SID has be assigned and the departure control frequency lished on the SID.

325. INSTRUMENT DEPARTURES

a. STANDARD INSTRUMENT DEPARTURES (

(1) A SID is an ATC coded departure pro which has been established at certain airports to s clearance delivery procedures.

(2) Pilots of civil aircraft operating from lo where SID procedures are effective may expect AT ances containing a SID. Use of a SID requires pilot sion of at least the textual description of the SID dures. Controllers may omit the departure control frequency if a SID clearance is issued and the departure control frequency is published on the SID. If the pilot does not possess a charted SID or a preprinted SID description or, for any other reason, does not wish to use a SID, he is expected to advise ATC. Notification may be accomplished by filing "NO SID" in the remarks section of the filed flight plan or by the less desirable method of verbally advising ATC.

(3) All effective SIDs are published in textual and graphic form by the National Ocean Service in East and West SID booklets.

(4) SID procedures will be depicted in one of two basic forms.

(a) Pilot Navigation (Pilot NAV) SIDs: are established where the pilot is primarily responsible for navigation on the SID route. They are established for airports when terrain and safety related factors indicate the necessity for a pilot NAV SID. Some pilot NAV SIDs may contain vector instructions which pilots are expected to comply with until instruction are received to resume normal navigation on the filed/assigned route or SID procedure.

(b) Vector SIDs: are established where ATC, will provide radar navigational guidance to a filed/assigned route or to a fix depicted on the SID.

b. OBSTRUCTION CLEARANCE DURING DEPARTURE

(1) Published instrument departure procedures and SIDs assist pilots conducting IFR flight in avoiding obstacles during climbout to minimum en route altitude (MEA). Standard instrument takeoff minimums and departure procedures are prescribed in FAR 91.116(f). Airports with takeoff minimums other than standard (one statute mile for aircraft having two engines or less and one-half statute mile for aircraft having more than two engines) are described in airport listings on separate pages, titled IFR TAKE-OFF MINIMUMS AND DEPARTURE PROCEDURES, at the front of each IAP book. The approach chart and SID chart for each airport with nonstandard takeoff minimums is annotated with a special symbol T. The use of this symbol indicates that the separate listing should be consulted. These minimums also apply to SIDs unless the SIDs specify different minimums.

(2) Obstacle clearance is based on the aircraft climbing at 200 feet per nautical mile, crossing the end of the runway at 35 feet AGL, and climbing to 400 feet above airport elevation before turning unless otherwise specified in the procedure. A slope of 152 feet per mile, starting no higher than 35 feet above the departure end of the runway, is assessed for obstacles. A minimum of 48 feet of obstacle clearance is provided for each mile of flight.

(a) If no obstacles penetrate the 152 feet per mile slope, IFR departure procedures are not published.

(b) If obstacles penetrate the slope, obstacle avoidance procedures are specified. These procedures may be: a ceiling and visibility to allow the obstacles to be seen and avoided; a climb gradient greater than 200 feet per mile; detailed flight maneuvers; or a combination of the above. In extreme cases, IFR takeoff may not be authorized for some runways.

EXAMPLE:

Rwy 17, 300-1 or standard with minimum climb of 220 feet per NM to 1100.

(3) Climb gradients are specified when required for obstacle clearance. Crossing restrictions in the SIDs may be established for traffic separation or obstacle clearance. When no gradient is specified, the pilot is expected to climb at least 200 feet per mile to MEA unless required to level off by a crossing restriction.

EXAMPLE:

"CROSS ALPHA INTERSECTION AT OR BELOW 4000; MAINTAIN 6000." The pilot climbs at least 200 feet per mile to 6000. If 4000 is reached before ALPHA, the pilot levels off at 4000 until passing ALPHA; then immediately resumes at least 200 feet per mile climb.

(4) Climb gradients may be specified to an altitude/fix, above which the normal gradient applies.

EXAMPLE:

"MINIMUM CLIMB 340 FEET PER NM TO 2700." The pilot climbs at least 340 feet per mile to 2700, then at least 200 feet per mile to MEA.

(5) Some procedures require a climb in visual conditions to cross the airport (or an on-airport NAVAID) at or above an altitude.

EXAMPLE:

"CLIMB VISUALLY TO CROSS THE AIRPORT AT OR ABOVE 8800, THEN CLIMB VIA R-293 TO ABC VOR."

(a) The specified ceiling and visibility minimums will be enough to allow the pilot to see and avoid obstacles near the airport. Obstacle avoidance is not guaranteed if the pilot maneuvers farther from the airport than the visibility minimum.

(b) That segment of the procedure which requires the pilot to see and avoid obstacles ends when the aircraft crosses the specified point at the required altitude. Thereafter, standard obstacle protection is provided.

(6) Each pilot, prior to departing an airport on an IFR flight should consider the type of terrain and other obstacles on or in the vicinity of the departure airport and:

(a) Determine whether a departure procedure and/or SID is available for obstacle avoidance.

(b) Determine if obstacle avoidance can be maintained visually or that the departure procedure or SID should be followed.

(c) Determine what action will be necessary and take such action that will assure a safe departure.

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NOTES

Section 7. EN ROUTE PROCEDURES

340. ARTCC COMMUNICATIONS

a. DIRECT COMMUNICATIONS — CONTROLLERS AND PILOTS

(1) ARTCCs are capable of direct communications with IFR air traffic on certain frequencies. Maximum communications coverage is possible through the use of Remote Center Air/Ground (RCAG) sites comprised of both VHF and UHF transmitters and receivers. These sites are located throughout the U.S.. Although they may be several hundred miles away from the ARTCC, they are remoted to the various ARTCCs by land lines or microwave links. Since IFR operations are expedited through the use of direct communications, pilots are requested to use these frequencies strictly for communications pertinent to the control of IFR aircraft. Flight plan filing, en route weather, weather forecasts and similar data should be requested through FSSs, company radio, or appropriate military facilities capable of performing these services.

(2) An ARTCC is divided into sectors. Each sector is handled by one or a team of controllers and has its own sector discrete frequency. As a flight progresses from one sector to another, the pilot is requested to change to the appropriate sector discrete frequency.

(3) ATC Frequency Change Procedures:

(a) The following phraseology will be used by controllers to effect a frequency change:

EXAMPLE:

(Aircraft Identification) CONTACT (facility name or location name and terminal function) (frequency) AT (time, fix or altitude) OVER.

NOTE.— Pilots are expected to maintain a listening watch on the transferring controller's frequency until the time, fix or altitude specified. ATC will omit frequency change restrictions whenever pilot compliance is expected upon receipt.

(b) The following phraseology should be utilized by pilots for establishing contact with the designated facility:

1. When a position report will be made:

EXAMPLE:

(Name) CENTER, (aircraft identification), (position), OVER.

2. When no position report will be made:

EXAMPLE:

(Name) CENTER, (aircraft identification), ESTIMATING (reporting point and time) AT (altitude or flight level) CLIMBING (or descending) TO MAINTAIN (altitude or flight level) OVER.

3. When operating in a radar environment and no position report is required:

EXAMPLE:

(Name) CENTER, (aircraft identification) AT (exact altitude or flight level); or, if appropriate,

EXAMPLE:

LEAVING (exact altitude or flight level) CLIMBING (or descending) TO MAINTAIN (altitude or flight level) OVER.

NOTE.— Exact altitude or flight level means to the nearest 100 foot increment. Exact altitude or flight level reports on initial contact provide ATC with information required prior to using MODE C altitude information for separation purposes.

(c) At times controllers will ask pilots to verify that they are at a particular altitude. The phraseology used will be: "VERIFY AT (altitude)." In climbing or descending situations, controllers may ask pilots to "VERIFY ASSIGNED ALTITUDE AS (altitude)." Pilots should confirm that they are at the altitude stated by the controller or that the assigned altitude is correct as stated. If this is not the case, they should inform the controller of the actual altitude being maintained or the different assigned altitude.

CAUTION: Pilots should not take action to change their actual altitude or different assigned altitude to the altitude stated in the controllers verification request unless the controller specifically authorizes a change.

(4) ARTCC Radio Frequency Outage:

(a) ARTCCs normally have at least one back up radio receiver and transmitter system for each frequency which can usually be placed into service quickly with little or no disruption of ATC service. Occasionally, technical problems may cause a delay but switchover seldom takes more than 60 seconds. When it appears that the outage will not be quickly remedied, the ARTCC will usually request a nearby aircraft, if there is one, to switch to the affected frequency to broadcast communications instructions. It is important, therefore, that the pilot wait at least 1 minute before deciding that the ARTCC has actually experienced a radio frequency failure. When such an outage does occur, the pilot should, if workload and equipment capability permit, maintain a listening watch on the affected frequency while attempting to comply with the following recommended communications procedures:

1. If two-way communications cannot be established with the ARTCC after changing frequencies, a pilot should attempt to recontact the transferring controller for the assignment of an alternative frequency or other instructions.

2. When an ARTCC radio frequency failure occurs after two-way communications have been established, the pilot should attempt to reestablish contact with the center on any other known ARTCC frequency, preferably that of the next responsible sector when practicable, and ask for instructions. However, when the next normal frequency change along the route is known to involve another ATC facility, the pilot should contact that facility, if feasible, for instructions. If communications cannot be reestablished by either method, the pilot is expected to request communications instructions from the FSS appropriate to the route of flight.

NOTE.— The exchange of information between an aircraft and an ARTCC through an FSS is quicker than relay via company radio because the FSS has direct interphone lines to the responsible ARTCC sector. Accordingly, when circumstances dictate a choice between the two, during an ARTCC frequency outage, relay via FSS radio is recommended.

341. POSITION REPORTING

The safety and effectiveness of traffic control depends to a large extent on accurate position reporting. In order to provide the proper separation and expedite aircraft movements, ATC must be able to make accurate estimates of the progress of every aircraft operating on an IFR flight plan.

a. POSITION IDENTIFICATION

(1) When a position report is to be made passing a VOR radio facility, the time reported should be the time at which the first complete reversal of the "to/from" indicator is accomplished.

(2) When a position report is made passing a facility by means of an airborne ADF, the time reported should be the time at which the indicator makes a complete reversal.

(3) When an aural or a light panel indication is used to determine the time passing a reporting point, such as a fan marker, Z marker, cone of silence or intersection of range courses, the time should be noted when the signal is first received and again when it ceases. The mean of these two times should then be taken as the actual time over the fix.

(4) If a position is given with respect to distance and direction from a reporting point, the distance and direction should be computed as accurately as possible.

(5) Except for terminal area transition purposes, position reports or navigation with reference to aids not established for use in the structure in which flight is being conducted will not normally be required by ATC.

b. POSITION REPORTING POINTS

(1) FARs require pilots to maintain a listening watch on the appropriate frequency and, unless operating under the provisions of (c), to furnish position reports passing certain reporting points. Reporting points are indicated by symbols on en route charts. The designated compulsory reporting point symbol is a solid triangle and the "on request" reporting point symbol is the open triangle. Reports passing an "on request" reporting point are only necessary when requested by ATC.

c. POSITION REPORTING REQUIREMENTS

(1) **Flights along airways or routes —** A position report is required by all flights regardless of altitude, including those operating in accordance with an ATC clearance specifying "VFR ON TOP," over each designated compulsory reporting point along the route being flown.

(2) **Flight Along a Direct Route —** Regardless of the altitude or flight level being flown, including flights operating in accordance with an ATC clearance specifying "VFR ON TOP", pilots shall report over each reporting point used in the flight plan to define the route of flight.

(3) **Flights in a Radar Environment —** When informed by ATC that their aircraft are in "RADAR CONTACT," PILOTS SHOULD DISCONTINUE POSITION REPORTS OVER DESIGNATED REPORTING POINTS. They should resume normal position reporting when ATC advises "RADAR CONTACT LOST" or "RADAR SERVICE TERMINATED."

NOTE.— ATC will inform a pilot that he is in "RADAR CONTACT" (a) when his aircraft is initially identified in the ATC system; and (b) when radar identification is reestablished after radar service has been terminated or radar contact lost. Subsequent to being advised that the controller has established radar contact, this fact will not be repeated to the pilot when handed off to another controller. At times, the aircraft identity will be *confirmed* by the receiving controller; however, this should not be construed to mean that radar contact has been lost. The identity of transponder equipped aircraft will be confirmed by asking the pilot to "IDENT," "SQUAWK STANDBY," or to change codes. Aircraft without transponders will be advised of their position to confirm identity. In this case, *the pilot is expected to advise the controller if he disagrees with the position given.* If the pilot cannot confirm the accuracy of the position given because he is not tuned to the NAVAID referenced by the controller, the pilot should ask for another radar position relative to the NAVAID to which he is tuned.

d. POSITION REPORT ITEMS

(1) Position reports should include the following items:

(a) Identification.

(b) Position.

(c) Time.

(d) Altitude or flight level (include actual altitude or flight level when operating on a clearance specifying VFR ON TOP.)

(e) Type of flight plan (not required in IFR position reports made directly to ARTCCs or approach control),

(f) ETA and name of next reporting point.

(g) The name only of the next succeeding reporting point along the route of flight, and

(h) Pertinent remarks.

342. ADDITIONAL REPORTS

a. The following reports should be made to ATC or FSS facilities without a specific ATC request:

(1) *At all times:*

(a) When vacating any previously assigned altitude or flight level for a newly assigned altitude or flight level.

(b) When an altitude change will be made if operating on a clearance specifying VFR ON TOP.

(c) When *unable* to climb/descend at a rate of at least 500 feet per minute.

(d) When approach has been missed. (Request clearance for specific action; i.e., to alternative airport, another approach, etc.)

(e) Change in the average true airspeed (at cruising altitude) when it varies by 5 percent or 10 knots (whichever is greater) from that filed in the flight plan.

(f) The time and altitude or flight level upon reaching a holding fix or point to which cleared.

(g) When leaving any assigned holding fix or point.

NOTE.— The reports in subparagraphs (f) and (g) may be omitted by pilots of aircraft involved in instrument training at military terminal area facilities when radar service is being provided.

(h) Any loss, in controlled airspace, of VOR, TACAN, ADF, low frequency navigation receiver capability y, complete or partial loss of ILS receiver capability or npairment of air/ground communications capability.

(l) Any information relating to the safety of flight.

(2) *When not in radar contact:*

(a) When leaving final approach fix inbound on inal approach.

(b) A corrected estimate at anytime it becomes aparent that an estimate as previously submitted is in error n excess of 3 minutes.

b. Pilots encountering weather conditions which have ot been forecast, or hazardous conditions which have been orecast, are expected to forward a report of such weather o ATC. (See PARA—520 - PILOT WEATHER REPORTS PIREPs) and FAR—91.125(b) and (c).)

43. AIRWAYS AND ROUTE SYSTEMS

a. Three route systems have been established for air avigation purposes. They are the VOR and L/MF system, he jet route system, and the area navigation (RNAV) oute system. To the extent possible, these route systems re aligned in an overlying manner to facilitate transition etween each.

(1) The VOR and L/MF Airway System consists of irways designated from 1,200 feet above the surface (or in ome instances higher) up to but not including 18,000 feet MSL. These airways are depicted on En Route Low Altiude Charts.

(a) THE VOR AIRWAYS are predicated solely on VOR or VORTAC navigation aids, except in Alaska, and are depicted in blue on aeronautical charts and are identified by a "V" (Victor) followed by the airway number (e.g., V12).

NOTE.— Segments of VOR airways in Alaska are based on L/MF navigation aids and charted in brown color instead of blue on n route charts.

1. A segment of an airway which is common to wo or more routes carries the numbers of all the airways which coincide for that segment. When such is the case, a pilot filing a flight plan needs to indicate only that airway number of the route which he is using.

2. *Alternate Airways* are identified by their location with respect to the associated main airway. "Victor 9 West" indicates an alternate airway associated with, and lying to the west of Victor 9.

NOTE.— A pilot who intends to make an airway flight, using VOR facilities, will simply specify the appropriate "Victor" airways(s) in his flight plan. For example, if a flight is to be made from Chicago to New Orleans at 8,000 feet, using omniranges only, the route may be indicated as "Departing from Chicago-Midway, cruising 8,000 feet via Victor 9 to Moisant International." If flight is to be conducted in part by means of L/MF navigation aids and in part on omniranges, specifications of the appropriate airways in the flight plan will indicate which types of facilities will be used along the described routes, and, for IFR flight, permit ATC to issue a traffic clearance accordingly. A route may also be described by specifying the station over which the flight will pass, but in this case since many VOR's and L/MF aids have the same name, the pilot must be careful to indicate which aid will be used at a particular location. This will be indicated in the route of flight portion of the flight plan by specifying the type of facility to be used after the location name in the following manner: Newark L/MF, Allentown VOR.

3. With respect to position reporting, reporting points are designated for VOR Airway Systems. Flights using Victor Airways will report over these points unless advised otherwise by ATC.

(b) THE L/MF AIRWAYS (colored airways) are predicated solely on L/MF navigation aids and are depicted in brown on aeronautical charts and are identified by color name and number (e.g., Amber One). Green and Red airways are plotted east and west. Amber and Blue airways are plotted north and south.

NOTE.— The colored airway system exists only in the State of Alaska. All such airways formerly designated within the conterminous U.S. have been rescinded.

(2) THE JET ROUTE SYSTEM consists of jet routes established from 18,000 feet MSL to FL 450 inclusive.

(a) These routes are depicted on En Route High Altitude Charts. Jet routes are depicted in blue on aeronautical charts and are identified by a "J" (Jet) followed by the airway number (e.g., J 12). Jet routes, as VOR airways, are predicated solely on VOR or VORTAC navigation facilities (except in Alaska).

NOTE.— Segments of jet routes in Alaska are based on L/MF navigation aids and are charted in brown color instead of blue on en route charts.

(b) With respect to position reporting, reporting points are designated for Jet Route systems. Flights using Jet Routes will report over these points unless otherwise advised by ATC.

(3) AREA NAVIGATION (RNAV) ROUTE SYSTEM

(a) Area navigation systems permit aircraft operations on any desired course within the coverage of station-referenced navigation signals or within the limits of self-contained system capability. Typical of such systems are VOR/DME RNAV, INS, LORAN C, and OMEGA.

(b) Except for a few high altitude Alaskan routes, there is no longer a U.S. RNAV route system. Provisions are retained for designation of RNAV routes if they are required; however, these routes would be depicted on En Route High Altitude Charts. Special certification requirements for RNAV equipment apply to these routes.

(c) In the absence of established RNAV routes, random RNAV routes may be filed, but radar monitoring by ATC will be required.

b. OPERATION ABOVE FL 450 may be conducted on a point-to-point basis. Navigational guidance is provided on an area basis utilizing those facilities depicted on the En Route High Altitude Charts.

c. **Radar Vectors.** Controllers may vector aircraft within controlled airspace for separation purposes, noise abatement considerations, when an operational advantage will be realized by the pilot or the controller, or when requested by the pilot. Vectors outside of controlled airspace will be provided only on pilot request. Pilots will be advised as to what the vector is to achieve when the vector is controller initiated and will take the aircraft off a previously assigned nonradar route. To the extent possible, aircraft operating on RNAV routes will be allowed to remain on their own navigation.

d. **Pilots are cautioned when flying in Canadian airspace, to review Canadian Air Regulations.**

(1) Special attention should be given to the parts which differ from U.S. FARs.

(a) The Canadian Airways CLASS B airspace restriction is an example. CLASS B airspace is all controlled low level airspace above 12,500 feet MSL or the MEA, whichever is higher, within which only IFR and controlled VFR flights are permitted. (Low level airspace means an airspace designated and defined as such in the *Designated Airspace Handbook.)*

(b) Regardless of the weather conditions or the height of the terrain, no person shall operate an aircraft under VFR conditions within CLASS B airspace except in accordance with a clearance for VFR flight issued by ATC.

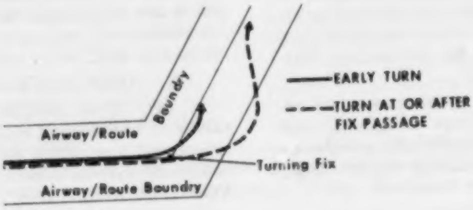
(c) Unless otherwise authorized by the Director General, Civil Aeronautics of the Department of Transportation, no person holding a commercial or private pilot license without an instrument rating shall operate an aircraft in VFR flight within CLASS B airspace unless successful completion of a written examination demonstrating knowledge of radio navigation and of ATC procedures applicable to IFR flight including clearances and position reports is accomplished. The pilot license must be endorsed to that effect.

(2) Segments of VOR airways and high level routes in Canada are based on L/MF navigation aids and are charted in brown color instead of blue on en route charts.

344. AIRWAY OR ROUTE COURSE CHANGES

a. Pilots of aircraft are required to adhere to airways routes being flown. Special attention must be given to th requirement during course changes. Each course chang consists of variables that make the technique applicable each case a matter only the pilot can resolve. Some vari bles which must be considered are turn radius, wind effec airspeed, degree of turn, and cockpit instrumentation. A early turn, as illustrated below, is one method of adheri to airways or routes. The use of any available cockpit i strumentation, such as distance measuring equipment, ma be used by the pilot to lead his turn when making cour changes. This *is consistent* with the intent of FAR- 91.123, which requires pilots to operate along the cente line of an airway and along the direct course between na gational aids or fixes.

b. Turns which begin at or after fix passage may exce airway or route boundaries. The following illustration co tains an example flight track depicting this, together w an example of an early turn.



c. Without such actions as leading a turn, aircraft operating in excess of 290 knots TAS can exceed the normal airway or route boundaries depending on the amount of course change required, wind direction and velocity, the character of the turn fix (DME, overhead navigation aid, or intersection), and the pilot's technique in making a course change. For example, a flight operating at 17,000 feet MSL with a TAS of 400 knots, a 25 degree bank, and a course change of more than 40 degrees would exceed the width of the airway or route; i.e., 4 nautical miles each side of centerline. However, in the airspace below 18,000 feet MSL, operations in excess of 290 knots TAS are not prevalent and the provision of additional IFR separation in all course change situations for the occasional aircraft making a turn in excess of 290 knots TAS creates an unacceptable waste of airspace and imposes a penalty upon the preponderance of traffic which operate at low speeds. Consequently, the FAA expects pilots to lead turns and take other actions they consider necessary during course changes to adhere as closely as possible to the airways or route being flown.

d. Due to the high airspeeds used at 18,000 feet MSL and above, FAA provides additional IFR separation protection for course changes made at such altitude levels.

345. CHANGEOVER POINTS (COP)

a. COPs are prescribed for federal airways, jet rou area navigation routes, or other direct routes for which MEA is designated under FAR—95. The COP is a p along the route or airway segment between two adja navigation facilities or way points where changeover navigation guidance should occur. At this point, the p should change navigation receiver frequency from the tion behind the aircraft to the station ahead.

b. The COP is located midway between the navig facilities for straight route segments, or at the intersec of radials or courses forming a dogleg in the case of do route segments. When the COP is NOT located at midway point, aeronautical charts will depict the COP cation and give the mileage to the radio aids.

c. COPs are established for the purpose of preven loss of navigation guidance, to prevent frequency inte ence from other facilities, and to prevent use of diffe facilities by different aircraft in the same airspace. P are urged to observe COPs to the fullest extent.

346. OPERATION IN RESTRICTED AIRSPACE

a. ATC facilities apply the following procedures when aircraft are operating on an IFR clearance (including those cleared by ATC to maintain VFR ON TOP) via a route which lies within joint-use restricted airspace.

(1) If the restricted area is not active and has been released to the controlling agency (FAA), the ATC facility will allow the aircraft to operate in the restricted airspace without issuing specific clearance for it to do so.

(2) If the restricted area is active and has not been released to the controlling agency (FAA), the ATC facility will issue a clearance which will ensure the aircraft avoids the restricted airspace unless it is on an approved altitude reservation mission or has obtained its own permission to operate in the airspace and so informs the controlling facility.

NOTE.— The above apply only to joint-use restricted airspace and not to prohibited and nonjoint-use airspace. For the latter categories, the ATC facility will issue a clearance so the aircraft will avoid the restricted airspace unless it is on an approved altitude reservation mission or has obtained its own permission to operate in the airspace and so informs the controlling facility.

b. Restricted airspace is depicted on the En Route Chart appropriate for use at the altitude or flight level being flown. For joint-use restricted areas, the name of the controlling agency is shown on these charts. For all prohibited areas and nonjoint-use restricted areas, unless otherwise requested by the using agency, the phrase "NO A/G" is shown.

347. HOLDING

a. Whenever an aircraft is cleared to a fix other than the destination airport and delay is expected, it is the responsibility of the ATC controller to issue complete holding instructions (unless the pattern is charted), * an EFC time and his best estimate of any additional en route/terminal delay.

b. If the holding pattern is charted and the controller doesn't issue complete holding instructions, the pilot is expected to hold as depicted on the appropriate chart. When the pattern is charted, the controller may omit all holding instructions except the charted holding direction and the statement *AS PUBLISHED* e.g., *HOLD EAST AS PUBLISHED*. Controllers shall always issue complete holding instructions when pilots request them.

NOTE.—* Only those holding patterns depicted on U.S. Government or commercially produced (meeting FAA requirements) *Low/High Altitude En route, and Area or STAR* charts should be used.

c. If no holding pattern is charted and holding instructions have not been issued, the pilot should ask ATC for holding instructions prior to reaching the fix. This procedure will eliminate the possibility of an aircraft entering a holding pattern other than that desired by ATC. If the pilot is unable to obtain holding instructions prior to reaching the fix (due to frequency congestion, stuck microphone, etc.), he should hold in a standard pattern on the course on which he approached the fix and request further clearance as soon as possible. In this event, the altitude/flight level of the aircraft at the clearance limit will be protected so that separation will be provided as required.

d. When an aircraft is 3 minutes or less from a clearance limit and a clearance beyond the fix has not been received, the pilot is expected to start a speed reduction so that he will cross the fix, initially, at or below the maximum holding airspeed.

e. When no delay is expected, the controller should issue a clearance beyond the fix as soon as possible and, whenever possible, at least 5 minutes before the aircraft reaches the clearance limit.

f. Pilots should report to ATC the time and altitude/flight level at which the aircraft reaches the clearance limit and report leaving the clearance limit.

NOTE.— In the event of two-way communications failure, pilots are required to comply with FAR 91.127.

g. When holding at a VOR station, pilots should begin the turn to the outbound leg at the time of the first complete reversal of the to/from indicator.

h. Patterns at the most generally used holding fixes are depicted (charted) on U.S. Government or commercially produced (meeting FAA requirements) Low or High Altitude En route, Area and STAR Charts. Pilots are expected to hold in the pattern depicted unless specifically advised otherwise by ATC.

i. An ATC clearance requiring an aircraft to hold at a fix where the pattern is not charted will include the following information:

(1) Direction of holding from the fix in terms of the eight cardinal compass points (i.e., N, NE, E, SE, etc.).

(2) Holding fix (the fix may be omitted if included at the beginning of the transmission as the clearance limit).

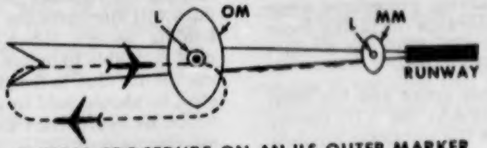
(3) Radial, course, bearing, airway or route on which the aircraft is to hold.

(4) Leg length in miles if DME or RNAV is to be used (leg length will be specified in minutes on pilot request or if the controller considers it necessary).

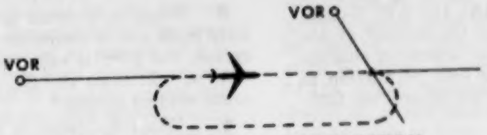
(5) Direction of turn if left turns are to be made, the pilot requests, or the controller considers it necessary.

(6) Time to expect further clearance and any pertinent additional delay information.

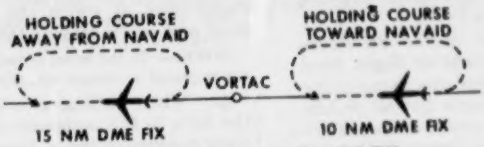
EXAMPLES OF HOLDING


L
OM
L
MM
RUNWAY

TYPICAL PROCEDURE ON AN ILS OUTER MARKER



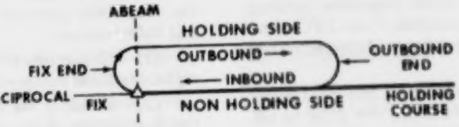
TYPICAL PROCEDURE AT INTERSECTION OF VOR RADIALS


HOLDING COURSE
AWAY FROM NAVAID
HOLDING COURSE
TOWARD NAVAID
VORTAC
15 NM DME FIX
10 NM DME FIX

TYPICAL PROCEDURE AT DME FIX

j. Holding pattern airspace protection is based on the following procedures. They are the only procedures for entry and holding recommended by FAA.

(1) Descriptive Terms


ABEAM
HOLDING SIDE
OUTBOUND
INBOUND
FIX END
OUTBOUND END
RECIPROCAL
FIX
NON HOLDING SIDE
HOLDING COURSE

(a) Standard Pattern : Right turns (illustrated)

(b) Nonstandard Pattern : Left turns

(2) Airspeeds (maximum)

(a) Propeller-driven

1. All (including turboprop)....................175K IAS

(b) Civil turbojet

1. MHA through 6,000 feet..........200K IAS

2. Above 6,000 feet through 14,000 feet....................210K IAS

3. Above 14,000 feet....................230K IAS

(c) Military turbojet

1. All-except aircraft listed below....................230K IAS

2. F-84F, F-100, F-102, F-104, F-106, T-38, F-4, F-8, F-11, F-14, F-15, F-16, A-5, A-7 (USAF only), AV-8....................265

3. F-4 (USAF only)....................280

4. F-100, F/RF-101, F-104, F-105, F-111, SR-71....................310

5. T-37....................175

NOTE.— Holding speed depends upon weight and drag
ration.

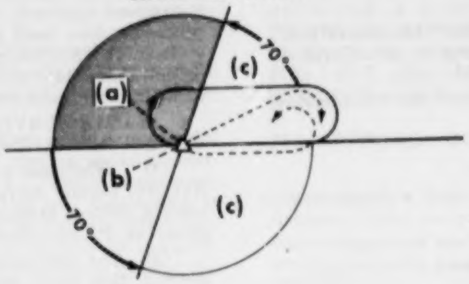
(3) Entry

(a) Parallel Procedure — Parallel holding course, urn left, and return to holding fix or intercept holding ourse.

(b) Teardrop Procedure — Proceed on outbound rack of 30 degrees (or less) to holding course, turn right to ntercept holding course.

(c) Direct Entry Procedure — Turn right and fly he pattern.

STANDARD PATTERN



(4) Timing:

(a) Inbound Leg

1. At/below 14,000 Ft. MSL - 1 minute.
2. Above 14,000 Ft. MSL - 1 and 1/2 minute.

NOTE.— The *initial* outbound leg should be flown for 1 minute or 1 and 1/2 min. (appropriate to altitude). Timing for subsequent outbound legs should be adjusted as necessary to achieve proper inbound leg time. Pilots may use any navigational means available (i.e. DME, RNAV, etc.) to insure the appropriate inbound leg times.

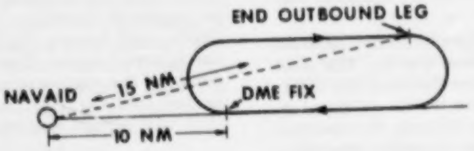
(b) Outbound leg timing begins *over / abeam* the fix, whichever occurs later. If the *abeam* position cannot be determined, start timing when turn to outbound is completed.

(5) Distance Measuring Equipment (DME)

(a) DME holding is subject to the same entry and holding procedures except that distances (nautical miles) are used in lieu of time values. The *outbound course* of a DME holding pattern is called the outbound leg of the pattern. The length of the outbound leg will be specified by the controller. The end of the outbound leg is determined by the odometer reading.

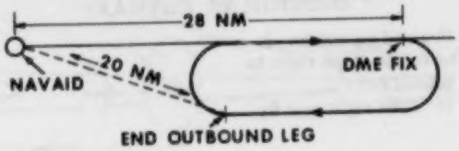
EXAMPLE:

When the inbound course is *toward* the NAVAID and the fix distance is 10 NM, and the leg length is 5NM, then the end of the outbound leg will be reached when the DME reads 15 NM.



EXAMPLE:

When the inbound course is *away* from the NAVAID and the fix distance is 28 NM and the leg length is 8 NM, then the end of the outbound leg will be reached when the DME reads 20 NM.



(6) Pilot Action

(a) Start speed reduction when 3 minutes or less from the holding fix. Cross the holding fix, initially, at or below the maximum holding airspeed.

(b) Make all turns during entry and while holding at:

1. 3 degrees per second, or
2. 30 degree bank angle, or
3. 25 degree bank provided a flight director system is used.

NOTE.— Use whichever requires the least bank angle.

(c) Compensate for known effect of wind, except when turning.

(d) Determine entry turn from aircraft heading upon arrival at the holding fix. Plus/minus 5 degrees in heading is considered to be within allowable good operating limits for determining entry.

(e) Advise ATC immediately if any increased airspeed is necessary due to turbulence, icing, etc., or if unable to accomplish any part of the holding procedures. When such higher speeds become no longer necessary, operate according to the appropriate published holding speed and notify ATC.

NOTE.— Airspace protection for turbulent air holding is based on a maximum of 280K IAS/Mach 0.8, whichever is lower. Considerable impact on traffic flow will result when turbulent air holding patterns are used; thus, pilot discretion will ensure their use is limited to bona fide conditions or requirements.

(7) Nonstandard Holding Pattern — Fix end and outbound end turns are made to the left. Entry procedures to a nonstandard pattern are oriented in relation to the 70 degree line on the holding side just as in the standard pattern.

k. When holding at a fix and instructions are received specifying the time of departure from the fix, the pilot should adjust his flight path within the limits of the established holding pattern in order to leave the fix at the exact time specified. After departing the holding fix, normal speed is to be resumed with respect to other governing speed requirements such as terminal area speed limits, specific ATC requests, etc. Where the fix is associated with an instrument approach, and timed approaches are in effec procedure turn shall not be executed unless the pilot vises ATC, since aircraft holding are expected to proc inbound on final approach directly from the holding p tern when approach clearance is received.

l. RADAR SURVEILLANCE OF OUTER FIX HOL ING PATTERN AIRSPACE AREAS.

(1) Whenever aircraft are holding at an outer ATC will usually provide radar surveillance of the outer holding pattern airspace area, or any portion of it, if i shown on the controller's radar scope.

(2) The controller will attempt to detect any hol aircraft that stray outside the holding pattern airsp area and will assist any detected aircraft to return to assigned airspace area.

NOTE.— Many factors could prevent ATC from providing additional service, such as workload, number of targets, preci tion, ground clutter, and radar system capability. These circ stances may make it unfeasible to maintain radar identificati aircraft to detect aircraft straying from the holding pattern provision of this service depends entirely upon whether the troller believes he is in a position to provide it and does not re a pilot of his responsibility to adhere to an accepted ATC c ance.

(3) If an aircraft is established in a published hol pattern at an assigned altitude above the published mi mum holding altitude and subsequently cleared for the proach, the pilot may descend to the published minim holding altitude. The holding pattern would only be a ment of the IAP *if* it is published on the instrument p cedure chart and is used in lieu of a procedure turn.

m. For those holding patterns where there are no p lished minimum holding altitudes, the pilot, upon recei an approach clearance, must maintain his last assigned titude until leaving the holding pattern and established the inbound course. Thereafter, the published minimum titude of the route segment being flown will apply. It is pected that the pilot will be assigned a holding altit that will permit a normal descent on the inbound co

348—359. RESERVED

Section 8. ARRIVAL PROCEDURES

360. STANDARD TERMINAL ARRIVAL (STAR)

a. A STAR is an ATC coded IFR arrival route established for application to arriving IFR aircraft destined for certain airports. Its purpose is to simplify clearance delivery procedures.

b. Pilots of IFR civil aircraft destined to locations for which STARs have been published may be issued a clearance containing a STAR whenever ATC deems it appropriate. Until military STAR publications and distribution is accomplished, STARs will be issued to military pilots only when requested in the flight plan or verbally by the pilot.

c. Use of STARs requires pilot possession of at least the approved textual description. As with any ATC clearance or portion thereof, it is the responsibility of each pilot to accept or refuse an issued STAR. A pilot should notify ATC if he does not wish to use a STAR by placing "NO STAR" in the remarks section of the flight plan or by the less desirable method of verbally stating the same to ATC.

d. A bound booklet containing all STAR charts is available on subscription from the National Ocean Service.

361. LOCAL FLOW TRAFFIC MANAGEMENT PROGRAM

a. This program is a continuing effort by the FAA to enhance safety, minimize the impact of aircraft noise and conserve aviation fuel. The enhancement of safety and reduction of noise is achieved in this program by minimizing low altitude maneuvering of arriving turbojet and turboprop aircraft weighing more than 12,500 pounds and, by permitting departure aircraft to climb to higher altitudes sooner, as arrivals are operating at higher altitudes at the points where their flight paths cross. The application of these procedures also reduces exposure time between controlled aircraft and uncontrolled aircraft at the lower altitudes in and around the terminal environment. Fuel conservation is accomplished by absorbing any necessary arrival delays for aircraft included in this program operating at the higher and more fuel efficient altitudes.

b. A fuel efficient descent is basically an uninterrupted descent (except where level flight is required for speed adjustment) from cruising altitude to the point when level flight is necessary for the pilot to stabilize his final approach. The procedure for a fuel efficient descent is based on an altitude loss which is most efficient for the majority of aircraft being served. This will generally result in a descent gradient window of 250-350 feet per nautical mile.

c. When crossing altitudes and speed restrictions are issued verbally or are depicted on a chart, ATC will expect the pilot to descend first to the crossing altitude and then reduce speed. Verbal clearances for descent will normally permit an uninterrupted descent in accordance with the procedure as described in paragraph b. above. Acceptance of a charted fuel efficient descent (Runway Profile Descent) clearance requires the pilot to adhere to the altitudes, speeds, and headings depicted on the charts unless otherwise instructed by ATC. PILOTS RECEIVING A CLEARANCE FOR A FUEL EFFICIENT DESCENT ARE EXPECTED TO ADVISE ATC IF THEY DO NOT HAVE RUNWAY PROFILE DESCENT CHARTS PUBLISHED FOR THAT AIRPORT OR ARE UNABLE TO COMPLY WITH THE CLEARANCE.

362. APPROACH CONTROL

a. Approach control is responsible for controlling all instrument flight operating within its area of responsibility. Approach control may serve one or more airfields, and control is exercised primarily by direct pilot and controller communications. Prior to arriving at the destination radio facility, instructions will be received from ARTCC to contact approach control on a specified frequency.

b. Radar Approach Control

(1) Where radar is approved for approach control service, it is used not only for radar approaches (ASR and PAR) but is also used to provide vectors in conjunction with published nonradar approaches based on radio NAVAIDs (ILS, MLS, VOR, NDB, TACAN). Radar vectors can provide course guidance and expedite traffic to the final approach course of any established IAP or to the traffic pattern for a visual approach. Approach control facilities that provide this radar service will operate in the following manner:

(a) Arriving aircraft are either cleared to an outer fix most appropriate to the route being flown with vertical separation and, if required, given holding information or, when radar handoffs are effected between the ARTCC and approach control, or between two approach control facilities, aircraft are cleared to the airport or to a fix so located that the handoff will be completed prior to the time the aircraft reaches the fix. When radar handoffs are utilized, successive arriving flights may be handed off to approach control with radar separation in lieu of vertical separation.

(b) After release to approach control, aircraft are vectored to the final approach course (ILS, MLS, VOR, ADF, etc.). Radar vectors and altitude or flight levels will be issued as required for spacing and separating aircraft. *Therefore, pilots must not deviate from the headings issued by approach control.* Aircraft will normally be informed when it is necessary to vector across the final approach course for spacing or other reasons. If approach course crossing is imminent and the pilot has not been informed that he will be vectored across the final approach course, he should query the controller.

(c) The pilot is not expected to turn inbound on the final approach course unless an approach clearance has been issued. This clearance will normally be issued with the final vector for interception of the final approach course, and the vector will be such as to enable the pilot to establish his aircraft on the final approach course prior to reaching the final approach fix.

(d) In the case of aircraft already inbound on the final approach course, approach clearance will be issued

prior to the aircraft reaching the final approach fix. When established inbound on the final approach course, radar separation will be maintained and the pilot will be expected to complete the approach utilizing the approach aid designated in the clearance (ILS, MLS, VOR, radio beacons, etc.) as the primary means of navigation. Therefore, once established on the final approach course, pilots must not deviate from it unless a clearance to do so is received from ATC.

(e) After passing the final approach fix on final approach, aircraft are expected to continue inbound on the final approach course and complete the approach or effect the missed approach procedure published for that airport.

(2) Whether aircraft are vectored to the appropriate final approach course or provide their own navigation on published routes to it, radar service is automatically terminated when the landing is completed or when instructed to change to advisory frequency at uncontrolled airports, whichever occurs first.

363. ADVANCE INFORMATION ON INSTRUMENT APPROACH

a. When landing at airports with approach control services and where two or more IAPs are published, pilots will be provided in advance of their arrival with the type of approach to expect or that they may be vectored for a visual approach. This information will be broadcast either by a controller or on ATIS. It will not be furnished when the visibility is three miles or better and the ceiling is at or above the highest initial approach altitude established for any low altitude IAP for the airport.

b. The purpose of this information is to aid the pilot in planning arrival actions; however, it is not an ATC clearance or commitment and is subject to change. Pilots should bear in mind that fluctuating weather, shifting winds, blocked runway, etc., are conditions which may result in changes to approach information previously received. It is important that the pilot advise ATC immediately if he is unable to execute the approach ATC advised will be used, or if he prefers another type of approach.

c. When making an IFR approach to an airport not served by a tower or FSS, after the ATC controller advises "CHANGE TO ADVISORY FREQUENCY APPROVED" you should broadcast your intentions, including the type of approach being executed, your position, and when over the final approach fix inbound. Continue to monitor the appropriate frequency (UNICOM, etc.) for reports from other pilots.

364. INSTRUMENT APPROACH PROCEDURE CHARTS

a. FAR—91.116a (Instrument Approaches to Civil Airports) requires the use of SIAPs prescribed for the airport in Part 97 unless otherwise authorized by the Administrator (including ATC). FAR—91.116g (Military Airports) requires civil pilots flying into or out of military airports to comply with the IAPs and takeoff and landing minimums prescribed by the authority having jurisdiction at those airports.

(1) All IAPs (standard and special, civil and military) are based on joint civil and military criteria contained in the U.S. Standard for TERPs. The design of IAPs based
criteria contained in TERPs, takes into account the inter
lationship between airports, facilities, and the surroundi
environment, terrain, obstacles, noise sensitivity, etc. Ap
propriate altitudes, courses, headings, distances, and othe
limitations are specified and, once approved, the proc
dures are published and distributed by government an
commercial cartographers as instrument approach chart

(2) Not all IAPs are published in chart form. Rada
IAPs are established where requirements and faciliti
exist but they are printed in tabular form in appropria
U.S. Government Flight Information Publications.

(3) A pilot adhering to the altitudes, flight paths, a
weather minimums depicted on the IAP chart or vecto
and altitudes issued by the radar controller, is assured
terrain and obstruction clearance and runway or airpo
alignment during approach for landing.

(4) IAPs are designed to provide an IFR descent fro
the en route environment to a point where a safe landin
can be made. They are prescribed and approved by appr
priate civil or military authority to ensure a safe desce
during instrument flight conditions at a specific airport.
is important that pilots understand these procedures a
their use prior to attempting to fly instrument approache

(5) TERPs criteria are provided for the following ty
of instrument approach procedures:

(a) Precision approaches where an electronic gl
slope is provided (PAR and ILS) and,

(b) Nonprecision approaches where glide slope i
formation is not provided (all approaches except PAR a
ILS).

b. The method used to depict prescribed altitudes on i
strument approach charts differs according to techniqu
employed by different chart publishers. Prescribed al
tudes may be depicted in three different configuratio
Minimum, maximum, and mandatory. The U.S. Gover
ment distributes charts produced by Defense Mappi
Agency (DMA) and NOS. Altitudes are depicted on the
charts in the profile view with underscore, overscore,
both to identify them as minimum, maximum, or manda
ry.

(1) Minimum Altitude will be depicted with the al
tude value underscored. Aircraft are required to maint
altitude at or above the depicted value.

(2) Maximum Altitude will be depicted with the al
tude value overscored. Aircraft are required to maintain
titude at or below the depicted value.

(3) Mandatory Altitude will be depicted with the al
tude value both underscored and overscored. Aircraft a
required to maintain altitude at the depicted value.

NOTE.— The underscore and overscore to identify manda
altitudes and the overscore to identify maximum altitudes
used almost exclusively by DMA for military charts. With
few exceptions, civil approach charts produced by NOS utilize
the underscore to identify minimum altitudes. Pilots are cautio
to adhere to altitudes as prescribed because, in certain instanc
they may be used as the basis for vertical separation of aircraft
ATC. When a depicted altitude is specified in the ATC clearan
that altitude becomes mandatory as defined above.

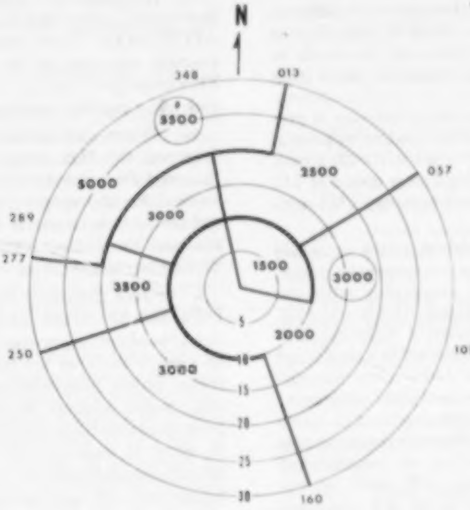
c. **Minimum Safe Altitudes (MSA)** are published
emergency use on approach procedure charts utili
NDB or VOR type facilities. The altitude shown provide

least 1,000 feet of clearance above the highest obstacle in the defined sector to a distance of 25 NM from the facility. As many as four sectors may be depicted with different altitudes for each sector displayed in rectangular boxes in the plan view of the chart. A single altitude for the entire area may be shown in the lower right portion of the plan view. Navigational course guidance is not assured at the MSA within these sectors.

d. Minimum Vectoring Altitudes (MVA) are established for use by ATC when radar ATC is exercised. MVA charts are prepared by air traffic facilities at locations where there are numerous different minimum IFR altitudes. Each MVA chart has sectors large enough to accommodate vectoring of aircraft within the sector at the MVA. Each sector boundary is at least 3 miles from the obstruction determining the MVA. To avoid a large sector with an excessively high MVA due to an isolated prominent obstruction, the obstruction may be enclosed in a buffer area whose boundaries are at least 3 miles from the obstruction. This is done to facilitate vectoring around the obstruction.

(1) The minimum vectoring altitude in each sector provides 1,000 feet above the highest obstacle in nonmountainous areas and 2,000 feet above the highest obstacle in designated mountainous areas. Where lower MVAs are required in designated mountainous areas to achieve compatibility with terminal routes or to permit vectoring to an IAP, 1,000 feet of obstacle clearance may be authorized with the use of Airport Surveillance Radar (ASR). The minimum vectoring altitude will provide at least 300 feet above the floor of controlled airspace.

(2) Because of differences in the areas considered for MVA, and those applied to other minimum altitudes, and the ability to isolate specific obstacles, some MVAs may be lower than the nonradar Minimum En route Altitudes (MEA), Minimum Obstruction Clearance Altitudes (MOCA) or other minimum altitudes depicted on charts for a given location. While being radar vectored, IFR altitude assignments by ATC will be at or above MVA.



e. Visual Descent Points (VDP) are incorporated in selected nonprecision approach procedures. The VDP is a defined point on the final approach course of a nonprecision straight-in approach procedure from which normal descent from the MDA to the runway touchdown point may be commenced, provided visual reference required by FAR—91.116(c)(3) is established. The VDP will normally be identified by DME on VOR and LOC procedures. The VDP is identified on the profile view of the approach chart by the symbol: V .

(1) VDPs are intended to provide additional guidance where they are implemented. No special technique is required to fly a procedure with a VDP. The pilot should not descend below the MDA prior to reaching the VDP and acquiring the necessary visual reference in accordance with FAR—91.116(c)(3)(4).

(2) Pilots not equipped to receive the VDP should fly the approach procedure as though no VDP had been provided.

365. APPROACH CLEARANCE

a. An aircraft which has been cleared to a holding fix and subsequently "cleared . . . approach" has not received new routing. Even though the "cleared . . . approach" may have been issued or received prior to the aircraft reaching the holding fix, ATC would expect the pilot to proceed via the holding fix (his last assigned route), a transition if one exists, and then to the initial approach fix to commence his approach.

b. If a transition fix is located along the route of flight en route to the holding fix and clearance for an approach is received, he should commence his approach from the transition fix if not already passed it.

c. If a route of flight directly to the initial approach fix is desired, it should be so stated by the controller with phraseology to include the words "direct . . .," "proceed direct" or a similar phrase which the pilot can interpret without question. If the pilot is uncertain of his clearance, he should immediately query ATC as to what route of flight is desired.

366—369. RESERVED

370. INSTRUMENT APPROACH PROCEDURES

a. Minimums are specified for various aircraft approach categories based upon a value 1.3 times the stalling speed of the aircraft in the landing configuration at maximum certificated gross landing weight. (See FAR 97.3(b)). If it is necessary, while circling to land, to maneuver at speeds in excess of the upper limit of the speed range for each category, due to the possibility of extending the circling maneuver beyond the area for which obstruction clearance is provided, the circling minimum for the next higher approach category should be used. For example, an aircraft which falls in Category C, but is circling to land at a speed of 141 knots or higher should use the approach category "D" minimum when circling to land.

b. When operating on an unpublished route or while being radar vectored, the pilot, when an approach clearance is received, shall, in addition to complying with the minimum altitudes for IFR operations (FAR—91.119), maintain his last assigned altitude unless a different altitude is assigned by ATC, or until the aircraft is established on a segment of a published route or IAP. After the aircraft is so established, published altitudes apply to descent within each succeeding route or approach segment unless a different altitude is assigned by ATC. Notwithstanding this pilot responsibility, for aircraft operating on unpublished routes or while being radar vectored, ATC will, except when conducting a radar approach, issue an IFR approach clearance only after the aircraft is established on a segment of a published route or IAP, or assigned an altitude to maintain until the aircraft is established on a segment of a published route or instrument approach procedure. For this purpose, the procedure turn of a published IAP shall not be considered a segment of that IAP until the aircraft reaches the initial fix or navigation facility upon which the procedure turn is predicated.

EXAMPLE:

CROSS REDDING VOR AT OR ABOVE FIVE THOUSAND, CLEARED FOR VOR RUNWAY THREE FOUR APPROACH. *or*

EXAMPLE:

FIVE MILES FROM OUTER MARKER, TURN RIGHT HEADING THREE THREE ZERO, MAINTAIN TWO THOUSAND UNTIL ESTABLISHED ON THE LOCALIZER, CLEARED FOR ILS RUNWAY THREE SIX APPROACH.

NOTE.— The altitude assigned will assure IFR obstructio clearance from the point at which the approach clearance is issu until established on a segment of a published route or IAP. I pilot is uncertain of the meaning of his clearance, he shall imme diately request clarification from ATC.

c. Several IAPs, using various navigation and approa aids may be authorized for an airport. ATC may adv that a particular approach procedure is being used, prima ily to expedite traffic. (See PARA—363 - ADVANCE I FORMATION ON INSTRUMENT APPROACH.) If a pil is issued a clearance that specifies a particular approa procedure, he is expected to notify ATC immediately if h desires a different one. In this event it may be necess for ATC to withhold clearance for the different approa until such time as traffic conditions permit. However, i the pilot is involved in an emergency situation he will b given priority. If the pilot is not familiar with the speci approach procedure, ATC should be advised and they w provide detailed information on the execution of the pro dure.

d. At times ATC may not specify a particular approa procedure in the clearance, but will state "CLEARED F APPROACH." Such clearance indicates that the pilot m execute any one of the authorized IAPs for that airp This clearance does not constitute approval for the pilot execute a contact approach or a visual approach.

e. When cleared for a specifically prescribed IAP; i "cleared for ILS runway one niner approach" or wh "cleared for approach" i.e., execution of any procedure p scribed for the airport, pilots shall execute the entire p cedure as described on the IAP Chart unless an approp ate new or revised ATC clearance is received, or the I flight plan is cancelled.

f. Pilots planning flights to locations served by spe IAPs should obtain advance approval from the owner the procedure. Approval by the owner is necessary beca special procedures are for the exclusive use of the single terest unless otherwise authorized by the owner. Addit ally, some special approach procedures require cert crew qualifications training, or other special considerati in order to execute the approach. Also, some of these proach procedures are based on privately owned nav tional aids. Owners of aids that are not for public use elect to turn off the aid for whatever reason they have; i.e., maintenance, conservation, etc. Air traffic trollers are not required to question pilots to determi they have permission to use the procedure. Controllers sume a pilot has obtained approval and is aware of any tails of the procedure if he flies an IFR flight plan to airport.

g. When executing an instrument approach an radio contact with an FAA facility, unless in "radar tact," report passing the final approach fix inbound.

h. If a missed approach is required, advise ATC an clude the reason (unless initiated by ATC). Comply the missed approach instructions for the instrument proach procedure being executed, unless otherwise dir by ATC. (See PARA—382 - MISSED APPROACH PARA—404 - MISSED APPROACH.)

371. PROCEDURE TURN

a. A procedure turn is specified when it is necessary to reverse direction to establish the aircraft inbound on an intermediate or final approach course. The IAP specifies the outbound and inbound courses, the distance within which the procedure turn shall be completed, and the side of the inbound course (by the magnetic compass direction) on which the turn shall be made. Unless otherwise restricted, the type and rate of the turn and the point at which the turn is begun is left to the discretion of the pilot. However, the maneuver must be completed within the prescribed procedure turn distance and not below the minimum altitude specified for its completion.

(1) When the approach procedure involves a procedure turn, a maximum speed of not greater than 250 knots (IAS) should be observed and the turn should be executed within the distance specified in the profile view. The normal procedure turn distance is 10 miles. This may be reduced to a minimum of 5 miles where only Category A or helicopter aircraft are to be operated or increased to as much as 15 miles to accommodate high performance aircraft.

(2) Where a holding pattern is specified in lieu of a procedure turn, the holding maneuver must be executed within the 1 minute time limitation or published leg length. The maneuver is completed when the aircraft is established on the inbound course after executing the appropriate holding pattern entry. If cleared for the approach prior to returning to the holding fix, and the aircraft is at the prescribed altitude, additional circuits of the holding pattern are not necessary nor expected by ATC. If the pilot elects to make additional circuits to lose excessive altitude or to become better established on course, it is his responsibility to so advise ATC when he receives his approach clearance.

(3) A teardrop procedure or penetration turn may be specified in some procedures for a required course reversal. The teardrop procedure consists of departure from an initial approach fix on an outbound course followed by a turn toward and intercepting the inbound course at or prior to the intermediate fix or point. Its purpose is to permit an aircraft to reverse direction and lose considerable altitude within reasonably limited airspace. Where no fix is available to mark the beginning of the intermediate segment, it shall be assumed to commence at a point 10 miles prior to the final approach fix. When the facility is located on the airport, an aircraft is considered to be on final approach upon completion of the penetration turn. However, the final approach segment begins on the final approach course 10 miles from the facility.

(4) A procedure turn may not be established when an approach can be made from a properly aligned holding pattern. In such cases, the holding pattern is established over an intermediate fix or a final approach fix and, as in the procedure turn, the descent from the minimum holding pattern altitude to the final approach fix altitude may not commence until the aircraft is established on the inbound course.

(5) A procedure turn is not required when an approach can be made directly from a specified intermediate fix to the final approach fix. In such cases, the term "NoPT" is used with the appropriate course and altitude to denote that the procedure turn is not required. If a procedure turn is desired, and when cleared to do so by ATC, descent below the procedure turn altitude should not be made until the aircraft is established on the inbound course, since some NoPT altitudes may be lower than the procedure turn altitudes.

b. Limitations on Procedure Turns.

(1) In the case of a radar initial approach to a final approach fix or position, or a timed approach from a holding fix, or where the procedure specifies "NoPT", no pilot may make a procedure turn unless, when he receives his final approach clearance, he so advises ATC and a clearance is received.

(2) When a teardrop procedure turn is depicted and a course reversal is required, this type turn must be executed.

(3) When a 1 minute holding pattern replaces the procedure turn, the standard entry and the holding pattern shall be followed except when RADAR VECTORING is provided.

(4) As otherwise restricted by notes and symbols on the procedure charts.

372. TIMED APPROACHES FROM A HOLDING FIX

a. TIMED APPROACHES may be conducted when the following conditions are met:

(1) A control tower is in operation at the airport where the approaches are conducted.

(2) Direct communications are maintained between the pilot and the center or approach controller until the pilot is instructed to contact the tower.

(3) If more than one missed approach procedure is available, none require a course reversal.

(4) If only one missed approach procedure is available, the following conditions are met:

(a) Course reversal is not required; and,

(b) Reported ceiling and visibility are equal to or greater than the highest prescribed circling minimums for the IAP.

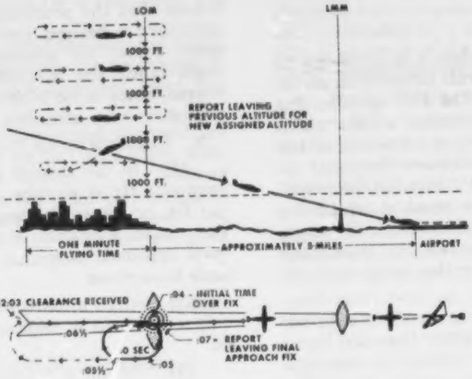
(5) When cleared for the approach, pilots shall not execute a procedure turn. (FAR—91.116(h).)

b. Although the controller will not specifically state that "timed approaches are in progress", his assigning a time to depart the final approach fix inbound is indicative that timed approach procedures are being utilized, or in lieu of holding, he may use radar vectors to the final approach course to establish a mileage interval between aircraft that will insure the appropriate time sequence between the final approach fix and the airport.

c. Each pilot in an approach sequence will be given advance notice as to the time he should leave the holding point on approach to the airport. When a time to leave the holding point has been received, the pilot should adjust his flight path to leave the fix as closely as possible to the designated time.

EXAMPLE:

Time Approach Example — a final approach procedure from a holding pattern at a final approach fix (FAF).



At 12:03 local time, in the example shown, a pilot holding, receives instructions to leave the fix inbound at 12:07. These instructions are received just as the pilot has completed turn at the outbound end of the holding pattern and is proceeding inbound towards the fix. Arriving back over the fix, the pilot notes that the time is 12:04 and that he has 3 minutes to lose in order to leave the fix at the assigned time. Since the time remaining is more than 2 minutes, the pilot plans to fly a race track pattern rather than a 360 degrees turn, which would use up 2 minutes. The turns at the ends of the race track pattern will consume approximately 2 minutes. Three minutes to go, minus 2 minutes required for turns, leaves 1 minute for level flight. Since two portions of level flight will be required to get back to the fix inbound, the pilot halves the 1 minute remaining and plans to fly level for 30 seconds outbound before starting his turn back toward the fix on final approach. If the winds were negligible at flight altitude, this procedure would bring the pilot inbound across the fix precisely at the specified time of 12:07. However, if the pilot expected a headwind on final approach, he should shorten his 30 seconds outbound course somewhat, knowing that the wind will carry him away from the fix faster while outbound and decrease his ground speed while returning to the fix. On the other hand, if the pilot knew he would have a tailwind on final approach, he should lengthen his calculated 30-second outbound heading somewhat, knowing that the wind would tend to hold him closer to the fix while outbound and increase his ground speed while returning to the fix.

373. RADAR APPROACHES

a. The only airborne radio equipment required for radar approaches is a functioning radio transmitter and receiver. The radar controller vectors the aircraft to align it with the runway centerline. The controller continues the vectors to keep the aircraft on course until the pilot can complete the approach and landing by visual reference to the surface. There are two types of radar approaches: Precision (PAR) and Surveillance (ASR).

b. A radar approach may be given to any aircraft upon request and may be offered to pilots of aircraft in distress or to expedite traffic, however, an ASR might not be approved unless there is an ATC operational requirement, or in an unusual or emergency situation. Acceptance of a PAR or ASR by a pilot does not waive the prescribed weather minimums for the airport or for the particular aircraft operator concerned. The decision to make a radar approach when the reported weather is below the established minimums rests with the pilot.

c. PAR and ASR minimums are published on separate pages in the NOS IAP Charts.

(1) **A PRECISION APPROACH (PAR)** is one in which a controller provides highly accurate nagivational guidance in azimuth and elevation to a pilot. Pilots are given headings to fly, to direct them to, and keep their aircraft aligned with the extended centerline of the landing runway. They are told to anticipate glide path interception approximately 10 to 30 seconds before it occurs and when to start descent. The published decision height will be given only if the pilot requests it. If the aircraft is observed to deviate above or below the glide path, the pilot is given the relative amount of deviation by use of terms "slightly" or "well" and is expected to adjust his rate of descent to return to the glide path. Range from touchdown is given at least once each mile. If an aircraft is observed by the controller to proceed outside of specified safety zone limits in azimuth and/or elevation and continue to operate outside these prescribed limits, the pilot will be directed to execute a missed approach or to fly a specified course unless he has the runway environment (runway, approach lights, etc.) in sight. Navigational guidance in azimuth and elevation is provided the pilot until the aircraft reaches the published Decision Height (DH). Advisory course and glidepath information is furnished by the controller until the aircraft passes over the landing threshold, at which point the pilot is advised of any deviation from the runway centerline. Radar service is automatically terminated upon completion of the approach.

(2) A SURVEILLANCE APPROACH (ASR) is one in which a controller provides navigational guidance in azimuth only. The pilot is furnished headings to fly to align his aircraft with the extended centerline of the landing runway. Since the radar information used for a surveillance approach is considerably less precise than that used for a precision approach, the accuracy of the approach will not be as great and higher minimums will apply. Guidance in elevation is not possible but the pilot will be advised when to commence descent to the minimum descent altitude (MDA) or, if appropriate, to an intermediate stepdown fix minimum crossing altitude and subsequently to the prescribed MDA. In addition, the pilot will be advised of the location of the missed approach point (MAP) prescribed for the procedure and his position each mile on final from the runway, airport or heliport or MAP, as appropriate. If requested by the pilot, recommended altitudes will be issued at each mile, based on the descent gradient established for the procedure, down to the last mile that is at or above the MDA. Normally, navigational guidance will be provided until the aircraft reaches the MAP. Controllers will terminate guidance and instruct the pilot to execute a missed approach unless at the MAP the pilot has the runway, airport or heliport in sight or, for a helicopter point-in-space approach, the prescribed visual reference with the surface is established. Also, if, at any time during the approach the controller considers that safe guidance for the remainder of the approach can not be provided, he will terminate guidance and instruct the pilot to execute a missed approach. Similarly, guidance termination and missed approach will be effected upon pilot request and, for civil aircraft only, controllers may terminate guidance when the pilot reports the runway, airport/heliport or visual surface route (point-in-space approach) in sight or otherwise indicates that continued guidance is not required. Radar service is automatically terminated at the completion of a radar approach.

NOTE.— The published MDA for straight-in approaches will be issued to the pilot before beginning descent. When a surveillance approach will terminate in a circle to land maneuver, the pilot must furnish the aircraft approach category to the controller. The controller will then provide the pilot with the appropriate MDA.

(3) A NO-GYRO APPROACH is available to a pilot under radar control who experiences circumstances wherein his directional gyro or other stabilized compass is inoperative or inaccurate. When this occurs, he should so advise ATC and request a No-Gyro vector or approach. Pilots of aircraft not equipped with a directional gyro or other stabilized compass who desire radar handling may also request a No-Gyro vector or approach. The pilot should make all turns at standard rate and should execute the turn immediately upon receipt of instructions. For example, "TURN RIGHT," "STOP TURN." When a surveillance or precision approach is made, the pilot will be advised after his aircraft has been turned onto final approach to make turns at half standard rate.

374. RADAR MONITORING OF INSTRUMENT APPROACHES

a. PAR facilities operated by the FAA and the military services at some joint-use (civil and military) and military installations monitor aircraft on instrument approaches and issue radar advisories to the pilot when weather is below VFR minima (1,000 and 3), at night, or when requested by a pilot. This service is provided only when the PAR final approach course coincides with the final approach of the navigational aid and only during the operational hours of the PAR. The radar advisories serve only as a secondary aid since the pilot has selected the navigational aid as the primary aid for the approach.

b. Prior to starting final approach, the pilot will be advised of the frequency on which the advisories will be transmitted. If, for any reason, radar advisories cannot be furnished, the pilot will be so advised.

c. Advisory information, derived from radar observations, includes information on:

(1) Passing the final approach fix.

NOTE.— At this point, the pilot may be requested to report sighting the approach lights or the runway.

(2) Trend advisories with respect to elevation and/or azimuth radar position and movement will be provided.

NOTE.— Whenever the aircraft nears the PAR safety limit, the pilot will be advised that he is well above or below the glidepath or well left or right of course. Glidepath information is given only to those aircraft executing a precision approach, such as ILS or MLS. Altitude information is not transmitted to aircraft executing other than precision approaches because the descent portions of these approaches generally do not coincide with the depicted PAR glidepath. At locations where the MLS glidepath and PAR glidepath are not coincidental, only azimuth monitoring will be provided.

(3) If, after repeated advisories, the aircraft proceeds outside the PAR safety limit or if a radical deviation is observed, the pilot will be advised to execute a missed approach unless the prescribed visual reference with the surface is established.

d. Radar service is automatically terminated upon completion of the approach.

375. SIMULTANEOUS ILS/MLS APPROACHES

a. System: An approach system permitting simultaneous ILS/MLS, or ILS and MLS approaches to airports having parallel runways separated by at least 4,300 feet between centerlines. Integral parts of a total system are ILS or MLS, radar, communications, ATC procedures, and appropriate airborne equipment. The Approach Procedure Chart permitting simultaneous approaches will contain the note "simultaneous approach authorized Rwys 14L and 14R" identifying the appropriate runways as the case may be. When advised that simultaneous ILS approaches are in progress, pilots shall advise approach control immediately of malfunctioning or inoperative receivers or if simultaneous approach is not desired.

b. Radar Monitor Service: This service is provided for each ILS/MLS to insure prescribed lateral separation during approaches. Pilots will be assigned frequencies to receive advisories and instructions. Aircraft deviating from either final approach course to the point where the no transgression zone (an area at least 2,000 feet wide) may be penetrated will be instructed to take corrective action. If an aircraft fails to respond to such instruction, the aircraft on the adjacent final approach course may be instructed to alter course.

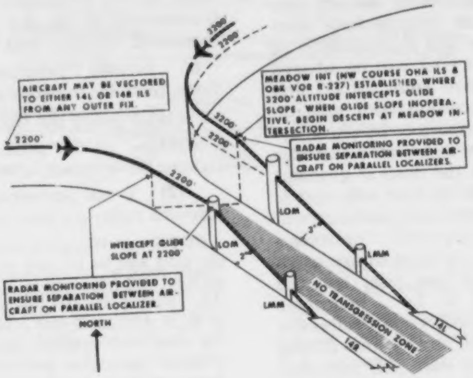
c. **Radar Advisories:** Whenever simultaneous approaches are in progress radar advisories will be provided on the tower frequency.

(1) The monitor controller will have the capability of overriding the tower controller on the tower frequency.

(2) The pilot will be advised to monitor the tower frequency.

(3) The monitor will automatically be terminated farther than one mile from the runway threshold.

(4) The monitor controller will *not* advise when th monitor is terminated.


3200'
2200'
AIRCRAFT MAY BE VECTORED TO EITHER 14L OR 14R ILS FROM ANY OUTER FIX.
MEADOW INT (NW COURSE OHA ILS & OBK VOR R-227) ESTABLISHED WHERE 3200' ALTITUDE INTERCEPTS GLIDE SLOPE. WHEN GLIDE SLOPE INOPERATIVE, BEGIN DESCENT AT MEADOW INTERSECTION.
3200'
2200'
RADAR MONITORING PROVIDED TO INSURE SEPARATION BETWEEN AIRCRAFT ON PARALLEL LOCALIZERS.
2200'
2200'
LOM
3°
LMM
INTERCEPT GLIDE SLOPE AT 2200'
LOM
2°
RADAR MONITORING PROVIDED TO INSURE SEPARATION BETWEEN AIRCRAFT ON PARALLEL LOCALIZER
LMM
NO TRANSGRESSION ZONE
14L
14R
NORTH

376. PARALLEL ILS/MLS APPROACHES

a. Parallel approaches are an ATC procedure permitting parallel ILS, MLS, or ILS and MLS approaches to airports having parallel runways separated by at least 2,500 feet between centerlines. Integral parts of a total system are ILS or MLS, radar, communications, ATC procedures, and appropriate airborne equipment.

b. A parallel approach differs from a simultaneous approach in that the minimum distance between parallel runway centerlines is reduced; there is no requirement for radar monitoring or advisories; and a staggered separation of aircraft on the adjacent localizer course is required.

c. Aircraft are afforded a minimum of two miles radar separation between successive aircraft on the adjacent localizer course and a minimum of three miles radar separation from aircraft on the same final approach course. In addition, a minimum of 1,000 feet vertical or a minimum of three miles radar separation is provided between aircraft during turn on.

d. Whenever parallel approaches are in progress, aircraft are informed that approaches to both runways are in use. In addition, the radar controller will have the interphone capability of communicating directly with the tower controller where the responsibility for radar separation is not performed by the tower controller.

377—379. RESERVED

380. SIDE-STEP MANEUVER

a. ATC may authorize an approach procedure whi serves either one of parallel runways that are separated 1,200 feet or less followed by a straight-in landing on t adjacent runway.

b. Aircraft that will execute a side-step maneuver w be cleared for a specified approach and landing on the jacent parallel runway. Example, "cleared for ILS runw 07 left approach, side-step to runway 07 right." Pilots expected to commence the side-step maneuver as soon possible after the runway or runway environment is sight.

c. Landing minima to the adjacent runway will higher than the minima to the primary runway, but normally be lower than the published circling minima.

381. WEATHER MINIMUMS

a. **LANDING MINIMUMS.** The rules applicabl landing minimums are contained in FAR—91.116.

b. **Straight-in-minimums** are shown on IAP ch when the final approach course of the IAP is within 30 grees of the runway alignment and a normal descent be made from the IFR altitude shown on the IAPs to runway surface. When either the normal rate of descen the runway alignment factor of 30 degrees is exceede straight-in minimum is not published and a circling m mum applies. The fact that a straight-in minimum is published does not preclude the pilot from landing stra in if he has the active runway in sight and has suffi time to make a normal approach for landing. Under such conditions and when ATC has cleared him for landing on that runway, he is not expected to circle even though only circling minimums are published. If he desires to circle he should advise ATC.

c. Side-Step Maneuver Minimums — Landing minima for a side-step maneuver to the adjacent runway will be higher than the minima to the primary runway but will normally be lower than the published circling minima.

d. Circling Minimums —The circling minimums published on the instrument approach chart provide adequate obstruction clearance and the pilot should not descend below the circling altitude until the aircraft is in a position to make final descent for landing. Sound judgement and knowledge of his and the aircraft's capabilities are the criteria for a pilot to determine the exact maneuver in each instance since airport design and the aircraft position, altitude and airspeed must all be considered. The following basic rules apply:

(1) Maneuver the shortest path to the base or downwind leg, as appproriate, under minimum weather conditions. There is no restriction from passing over the airport or other runways.

(2) It should be recognized that many circling maneuvers may be made while VFR or other flying is in progress at the airport. Standard left turns or specific instruction from the controller for maneuvering must be considered when circling to land.

(3) At airports without a control tower, it may be desirable to fly over the airport to determine wind and turn indicators, and to observe other traffic which may be on the runway or flying in the vicinity of the airport.

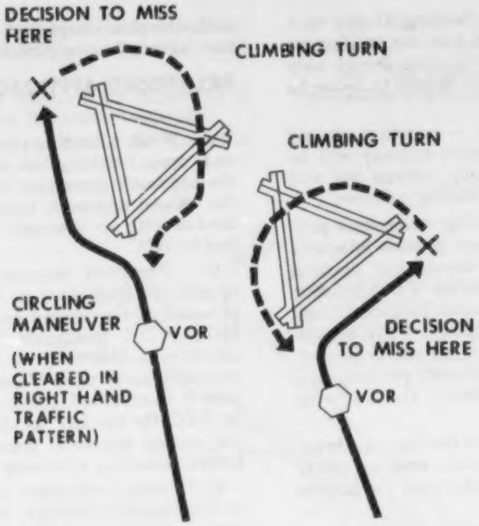
e. Instrument Approach At a Military Field — When instrument approaches are conducted by civil aircraft at military airports, they shall be conducted in accordance with the procedures and minimums approved by the military agency having jurisdiction over the airport.

382. MISSED APPROACH

a. When a landing cannot be accomplished, advise ATC and, upon reaching the missed approach point defined on the approach procedure chart, the pilot must comply with the missed approach instructions for the procedure being used or with an alternate missed approach procedure specified by ATC.

b. Protected obstacle clearance areas for missed approach are predicated on the assumption that the abort is initiated at the missed approach point not lower than the MDA or DH. Reasonable buffers are provided for normal maneuvers. However, no consideration is given to an abnormally early turn. Therefore, when an early missed approach is executed, pilots should, unless otherwise cleared by ATC, fly the IAP as specified on the approach plate to the missed approach point at or above the MDA or DH before executing a turning maneuver.

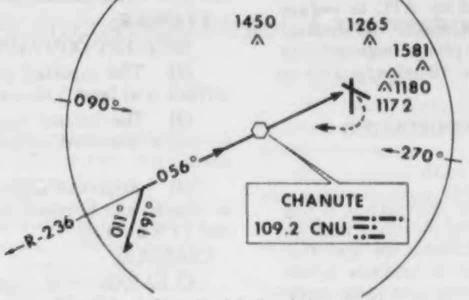
c. If visual reference is lost while circling to land from an instrument approach, the missed approach specified for that particular procedure must be followed (unless an alternate missed approach procedure is specified by ATC). To become established on the prescribed missed approach course, the pilot should make an initial climbing turn toward the landing runway and continue the turn until he is established on the missed approach course. Inasmuch as the circling maneuver may be accomplished in more than one direction, different patterns will be required to become established on the prescribed missed approach course, depending on the aircraft position at the time visual reference is lost. Adherence to the procedure will assure that an aircraft will remain within the circling and missed approach obstruction clearance areas.


DECISION TO MISS HERE
CLIMBING TURN
CLIMBING TURN
CIRCLING MANEUVER
(WHEN CLEARED IN RIGHT HAND TRAFFIC PATTERN)
VOR
DECISION TO MISS HERE
VOR

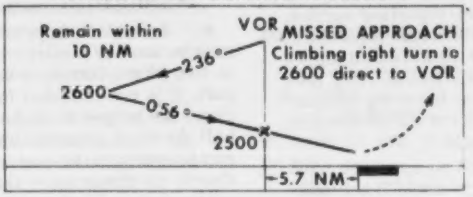
d. At locations where ATC Radar Service is provided, the pilot should conform to radar vectors when provided by ATC in lieu of the published missed approach procedure.

See diagram next page.

MISSED APPROACH-EXAMPLE



Portion of a Published Procedure



e. When approach has been missed, request clearance for specific action; i.e., to alternative airport, another approach, etc.

383. VISUAL APPROACH

a. When it will be operationally beneficial, ATC may authorize an aircraft to conduct a visual approach to an airport or to follow another aircraft when flight to, and landing at, the airport can be accomplished in VFR weather. The aircraft must have the airport or the identified preceding aircraft in sight before the clearance is issued. If the pilot has the airport in sight but cannot see the aircraft he is following, ATC may still clear the aircraft for a visual approach; however, ATC retains both separation and wake VORTEX separation responsibility. When visually following a preceding aircraft, acceptance of the visual approach clearance, constitutes acceptance of pilot responsibility for maintaining a safe approach interval and adequate wake turbulence separation.

b. When operating to an airport with an operating control tower, aircraft may be authorized to conduct a visual approach to one runway while other aircraft are conducting IFR or VFR approaches to another runway. When operating to airports with parallel runways separated by less than 2,500 feet, the succeeding aircraft must report sighting the preceding aircraft unless standard separation is being provided by ATC. When operating to parallel runways separated by at least 2,500 feet but less than 4,300 feet, controllers will clear/vector aircraft to the final at an angle not greater than 30 degrees unless radar, vertical, or visual separation is provided during the turn-on. The purpose of the 30 degree intercept angle is to reduce the potential for overshoots of the final and to preclude side-by-side operations with one or both aircraft in a *belly-up* configuration during the turn-on. Once the aircraft are established within 30 degrees of final, or on the final, these operations may be conducted simultaneously. When the parallel runways are separated by 4,300 feet or more, or intersecting/converging runways are in use, ATC may authorize a visual approach after advising all aircraft involved that other aircraft are conducting operations to the other runway.

c. When operating to an airport without weather reporting service, ATC may initiate a visual approach provided area weather reports indicate that VFR conditions exist at the airport and there is reasonable assurance that descent and flight to the airport can be made in VFR conditions. Pilot acceptance of a visual approach clearance or a pilot's request for a visual approach will indicate to ATC that the pilot can comply with FAR 91.105. ATC will advise the pilot when weather is not available at the destination airport.

d. Authorization to conduct a visual approach is an IFR authorization and does not alter IFR flight plan cancellation responsibility. (See PARA—304 - CANCELLING IFR FLIGHT PLAN.)

e. A visual approach is not an IAP and therefore has no missed approach segment. If a go around is necessary for any reason, aircraft operating at controlled airports will be issued an appropriate advisory/clearance/instruction by the tower. At uncontrolled airports, aircraft are expected to remain in VFR conditions and complete a landing as soon as possible. If a landing cannot be accomplished, the aircraft is expected to remain in VFR conditions and contact ATC as soon as possible for further clearance. Separation from other IFR aircraft will be maintained under these circumstances.

f. Visual approaches are initiated by ATC to reduce pilot/controller workload and expedite traffic by shortening flight paths to the airport. It is the pilot's responsibility to advise ATC as soon as possible if a visual approach is not desired.

384. CHARTED VISUAL FLIGHT PROCEDURES (CVFP)

a. In addition to conventional visual approaches, it has been necessary to develop CVFPs at some locations with jet operations. Although arrival routes/altitudes are specified to enhance noise abatement, they may be utilized by all categories of aircraft. CVFPs are used only in a radar environment at airports served by an operating control tower. These airports must also have weather reporting service. CVFPs originate over or near a prominent landmark. When the landmark cannot be readily identified at night, the procedure will be annotated, *PROCEDURE NOT AUTHORIZED AT NIGHT*. An aircraft not following another aircraft on approach may be cleared for a CVFP when it reports a charted visual landmark in sight.

b. Aircraft following another aircraft on approach must report sighting the preceding aircraft unless ATC is providing standard separation. When visually following a preceding aircraft, acceptance of a CVFP clearance constitutes pilot acceptance of responsibility for maintaining a safe approach interval and adequate wake turbulence separation. Recommended altitudes are established to indicate the noise abatement profile and minimum altitudes may be specified to contain aircraft above the floor of a TCA. These altitudes are not used by ATC for air traffic separation. Unless a particular CVFP has higher minima established, ATC will use the same weather criteria as visual approaches. Controllers will also apply the same separation criteria as visual approaches. A CVFP is not an instrument approach, therefore, it does not have a missed approach segment. Aircraft unable to complete a CVFP approach will be handled as any go-around.

385. CONTACT APPROACH

a. Pilots operating in accordance with an IFR flight plan, provided they are clear of clouds and have at least 1 mile flight visibility and can reasonably expect to continue to the destination airport in those conditions, may request ATC authorization for a contact approach.

b. Controllers may authorize a contact approach provided:

(1) The Contact Approach is specifically requested by the pilot. ATC cannot initiate this approach.

EXAMPLE:

REQUEST CONTACT APPROACH.

(2) The reported ground visibility at the destination airport is at least 1 statute mile.

(3) The contact approach will be made to an airport having a standard or special instrument approach procedure.

(4) Approved separation is applied between aircraft so cleared and between these aircraft and other IFR or special VFR aircraft.

EXAMPLE:

CLEARED FOR CONTACT APPROACH (and, if required) AT OR BELOW (altitude) (Routing) IF NOT POSSIBLE (alternative procedures) AND ADVISE.

c. A Contact Approach is an approach procedure that may be used by a pilot (with prior authorization from ATC) in lieu of conducting a standard or special IAP to an airport. It is not intended for use by a pilot on an IFR flight clearance to operate to an airport not having an authorized IAP. Nor is it intended for an aircraft to conduct an instrument approach to one airport and then, when "in the clear", to discontinue that approach and proceed to a other airport. In the execution of a contact approach, the pilot assumes the responsibility for obstruction clearance. If radar service is being received, it will automatically terminate when the pilot is told to contact the tower.

386. LANDING PRIORITY

A clearance for a specific type of approach (ILS, MLS ADF, VOR or Straight-in Approach) to an aircraft operating on an IFR flight plan does not mean that landing priority will be given over other traffic. ATCTs handle all ai craft, regardless of the type of flight plan, on a "first-come first-served" basis. Therefore, because of local traffic o runway in use, it may be necessary for the controller i the interest of safety, to provide a different landing s quence. In any case, a landing sequence will be issued t each aircraft as soon as possible to enable the pilot to prop erly adjust his flight path.

387—399. RESERVED

Section 9. PILOT/CONTROLLER ROLES AND RESPONSIBILITIES

400. GENERAL

a. The roles and responsibilities of the pilot and controller for effective participation in the ATC system are contained in several documents. Pilot responsibilities are in the FARs and the air traffic controller's are in the Air Traffic Control Handbook (7110.65) and supplemental FAA directives. Additional and supplemental information for pilots can be found in the current Airman's Information Manual (AIM), Notices to Airmen, Advisory Circulars and aeronautical charts. Since there are many other excellent publications produced by nongovernment organizations, as well as other government organizations, with various updating cycles, questions concerning the latest or most current material can be resolved by cross-checking with the above mentioned documents.

b. The pilot in command of an aircraft is directly responsible for, and is the final authority as to the safe operation of that aircraft. In an emergency requiring immediate action, the pilot in command may deviate from any rule in the General Subpart A and Flight Rules Subpart B in accordance with FAR—91.3.

c. The air traffic controller is responsible to give first priority to the separation of aircraft and to the issuance of radar safety alerts, second priority to other services that are required, but do not involve separation of aircraft and third priority to additional services to the extent possible.

d. In order to maintain a safe and efficient air traffic system, it is necessary that each party fulfill his responsibilities to the fullest.

e. The responsibilities of the pilot and the controller intentionally overlap in many areas providing a degree of redundancy. Should one or the other fail in any manner, this overlapping responsibility is expected to compensate, in many cases, for failures that may affect safety.

f. The following, while not intended to be all inclusive, is a brief listing of pilot and controller responsibilities for some commonly used procedures or phases of flight. More detailed explanations are contained in other portions of this publication, the appropriate FARs, ACs and similar publications. The information provided is an overview of the principles involved and is not meant as an interpretation of the rules nor is it intended to extend or diminish responsibilities.

401. AIR TRAFFIC CLEARANCE

a. Pilot

(1) Acknowledge receipt and understanding of an ATC clearance.

(2) Request clarification or amendment, as appropriate, any time a clearance is not fully understood, or considered unacceptable from a safety standpoint.

(3) Promptly comply with air traffic clearance upon receipt except as necessary to cope with an emergency. If deviation is necessary, advise ATC as soon as possible and obtain an amended clearance.

b. Controller

(1) Issues appropriate clearances for the operation to be conducted, or being conducted, in accordance with established criteria.

(2) Assigns altitudes in IFR clearances that are at or above the minimum IFR altitudes in controlled airspace.

(3) Ensures acknowledgement by the pilot for issued information, clearance or instructions.

(4) Ensures that readbacks by the pilot of altitude, heading, or other items are correct. If incorrect, distorted, or incomplete, makes corrections as appropriate.

402. CONTACT APPROACH

a. Pilot

(1) This approach must be requested by the pilot, and is made in lieu of a standard or special instrument approach.

(2) By requesting the contact approach, the pilot indicates that the flight is operating clear of clouds, has at least one mile flight visibility, and can reasonably expect to continue to the destination airport in those conditions.

(3) Be aware that while conducting a contact approach, the pilot assumes responsibility for obstruction clearance.

(4) Advise ATC immediately if you are unable to continue the contact approach or if you encounter less than one mile flight visibility.

b. Controller

(1) Issues clearance for contact approach only when requested by the pilot. Does not solict the use of this procedure.

(2) Before issuing clearance, ascertains that reported ground visibility at destination airport is at least one mile.

(3) Provides approved separation between aircraft cleared for contact approach and other IFR or special VFR aircraft. When using vertical separation, does not assign a fixed altitude but clears the aircraft at or below an altitude which is at least 1,000 feet below any IFR traffic but not below minimum safe altitudes prescribed in FAR—91.79.

(4) Issues alternative instructions if, in his judgment, weather conditions may make completion of the approach impracticable.

403. INSTRUMENT APPROACH

a. Pilot

(1) Be aware that the controller issues clearance for approach based only on known traffic.

(2) Follow the procedure as shown on the IAP, including all restrictive notations, such as:

(a) Procedure not authorized at night;

(b) Approach not authorized when local area altimeter not available;

(c) Procedure not authorized when control tower not in operation;

(d) Procedure not authorized when glide slope not used;

(e) Straight-in minima not authorized at night; etc.

(f) Radar required; or

(g) The circling minimums published on the instrument approach chart provide adequate obstruction clearance and the pilot should not descend below the circling altitude until the aircraft is in a position to make final descent for landing. Sound judgment and knowledge of his and the aircraft's capabilities are the criteria for a pilot to determine the exact maneuver in each instance since airport design and the aircraft position, altitude and airspeed must all be considered. (See PARA—381d, - CIRCLING MINIMUMS)

(3) Upon receipt of an approach clearance while on an unpublished route or being radar vectored:

(a) Comply with the minimum altitude for IFR, and

(b) Maintain last assigned altitude until established on a segment of a published route or IAP, at which time published altitudes apply.

b. Controller

(1) Issues an approach clearance based on known traffic.

(2) Issues an IFR approach clearance only after the aircraft is established on a segment of published route or IAP, or assigns an appropriate altitude for the aircraft to maintain until so established.

404. MISSED APPROACH

a. Pilot

(1) Execute a missed approach when one of the following conditions exist:

(a) Arrival at the Missed Approach Point (MAP) or the Decision Height (DH) and visual reference to the runway environment is insufficient to complete the landing.

(b) Determined that a safe landing is not possible.

(c) Instructed to do so by ATC.

(2) Advise ATC that a missed approach will be made. Include the reason for the missed approach unless the missed approach is initiated by ATC.

(3) Comply with the missed approach instructions for the IAP being executed unless other *missed approach* instructions are specified by ATC.

(4) If executing a missed approach prior to reaching the MAP or DH, fly the instrument procedure to the MAP at an altitude at or above the Minimum Descent Altitude (MDA) or DH before executing a turning maneuver.

(5) Radar vectors issued by ATC when informed that a missed approach is being executed supersedes the previous missed approach procedure.

(6) If making a missed approach from a radar approach, execute the missed approach procedure previously given or climb to the altitude and fly the heading specified by the controller.

(7) Following missed approach, request clearance fo specific action; i.e., another approach, hold for improv conditions, proceed to an alternate airport, etc.

b. Controller

(1) Issues an approved alternate missed approach procedure if it is desired that the pilot execute a procedure other than as depicted on the instrument approach cha

(2) May vector a radar identified aircraft executing missed approach when operationally advantageous to the pilot or the controller.

(3) In response to the pilot's stated intentions, issue a clearance to an alternate airport, to a holding fix, or fo reentry into the approach sequence, as traffic conditio permit.

405. RADAR VECTORS

a. Pilot

(1) Promptly comply with headings and altitudes a signed to you by the controller.

(2) Question any assigned heading or altitude b lieved to be incorrect.

(3) If operating VFR and compliance with any rad vector or altitude would cause a violation of any FA advise ATC and obtain a revised clearance or instructi

b. Controller

(1) Vectors aircraft in controlled airspace:

(a) For separation.

(b) For noise abatement.

(c) To obtain an operational advantage for the pi or controller.

(2) Vectors aircraft in controlled and uncontroll airspace when requested by the pilot.

(3) Vectors IFR aircraft at or above minimum vect ing altitudes.

(4) May vector VFR aircraft, not at an ATC assign altitude, at any altitude. In these cases, terrain separati is the pilot's responsibility.

406. SAFETY ALERT

a. Pilot

(1) Initiate appropriate action if a safety alert is re ceived from ATC.

(2) Be aware that this service is not always availa and that many factors affect the ability of the controller be aware of a situation in which unsafe proximity to te rain, obstructions or another aircraft may be developing

(3) This service is not a substitute for pilot adheren to safe operating practices.

b. Controller

(1) Issues a safety alert if he is aware an aircr under his control is at an altitude which, in the controller judgment, places the aircraft in unsafe proximity to te rain, obstructions or another aircraft. Types of safety ale are:

(a) **Terrain or Obstruction Alert:** — Immediat issued to an aircraft under his control if he is aware t ircraft is at an altitude believed to place the aircraft in nsafe proximity to terrain or obstructions.

(b) Aircraft Conflict Alert: — Immediately issued o an aircraft under his control if he is aware of an aircraft ot under his control at an altitude believed to place the ircraft in unsafe proximity to each other. With the alert, e offers the pilot an alternative, if feasible.

(2) Discontinues further alerts if informed by the ilot that he is taking action to correct the situation or hat he has the other aircraft in sight.

07. SEE AND AVOID

a. Pilot

(1) When meteorological conditions permit, regardless f type of flight plan, whether or not under control of a adar facility, the pilot is responsible to see and avoid ther traffic, terrain or obstacles.

b. Controller

(1) Provides radar traffic information to radar identiied aircraft operating outside positive control airspace on workload permitting basis.

(2) Issues a safety alert to an aircraft under his conrol if he is aware the aircraft is at an altitude believed to lace the aircraft in unsafe proximity to terrain, obstruc-ions or other aircraft.

08. SPEED ADJUSTMENTS

a. Pilot

(1) Advise ATC any time cruising airspeed varies plus r minus 5 percent, or 10 knots, whichever is greater. from hat given in the flight plan.

(2) Comply with speed adjustments from ATC unless:

(a) The minimum or maximum safe airspeed for ny particular operation is greater or less than the requested airspeed. In such cases, advise ATC.

(b) Operating at or above 10,000 feet MSL on an TC assigned SPEED ADJUSTMENT of more than 250 nots IAS and subsequent clearance is received for descent elow 10,000 feet MSL. In such cases, pilots are expected to omply with FAR—91.70(a).

(3) When complying with speed adjustments assignent, maintain an indicated airspeed within plus or minus 0 knots or .02 mach numbers of the specified speed.

b. Controller

(1) Assigns speed adjustments to aircraft when necesary but not as a substitute for good vectoring technique.

(2) Adheres to the restrictions published in the Conrollers Handbook (7110.65) as to when speed adjustment rocedures may be applied.

(3) Avoids speed adjustments requiring alternate decreases and increases.

(4) Assigns speed adjustments to a specified IAS KNOTS)/mach number or to increase or decrease speed sing increments of 10 knots or multiples thereof.

(5) Advises pilots to resume normal speed when speed djustments are no longer required.

(6) Gives due consideration to aircraft capabilities to educe speed while descending.

409. TRAFFIC ADVISORIES (Traffic Information)

a. Pilot

(1) Acknowledge receipt of traffic advisories.

(2) Inform controller if traffic in sight.

(3) Advise ATC if a vector to avoid traffic is desired.

(4) Do not expect to receive radar traffic advisories on all traffic. Some aircraft may not appear on the radar display. Be aware that the controller may be occupied with higher priority duties and unable to issue traffic information for a variety of reasons.

(5) Advise controller if service not desired.

b. Controller

(1) Issues radar traffic to the maximum extent consistent with higher priority duties except in positive controlled airspace.

(2) Provides vectors to assist aircraft to avoid observed traffic when requested by the pilot.

(3) Issues traffic information to aircraft in the airport traffic area for sequencing purposes.

410. VISUAL APPROACH

a. Pilot

(1) If a visual approach is not desired, advise ATC.

(2) Comply with controller's instructions for vectors toward the airport of intended landing or to a visual position behind a preceding aircraft.

(3) After being cleared for a visual approach, proceed to the airport in a normal manner or follow designated traffic and/or charted flight procedures, as appropriate remaining in VFR at all times.

(4) Acceptance of a visual approach clearance to visually follow a preceeding aircraft is pilot acknowledgement that he will establish a safe landing interval behind the preceding aircraft, if so cleared, and that he accepts responsibility for his own wake turbulence separation.

(5) Advise ATC immediately if you are unable to continue following a designated aircraft or encounter less than basic VFR weather conditions.

(6) Be aware that radar service is automatically terminated without advising the pilot when the aircraft is instructed to contact the tower.

(7) Be aware that there may be other traffic in the traffic pattern and the landing sequence may differ from the traffic sequence assigned by the approach control or ARTCC.

b. Controller

(1) Does not vector an aircraft for a visual approach to an airport with weather reporting service unless the reported ceiling at the airport is 500 feet or more above the MVA and visibility is three miles or more.

(2) Informs the pilot when weather is not available for the destination airport and does not vector for a visual approach to those airports unless there is reasonable assurance that descent and flight to the airport can be made in VFR conditions.

(3) Does not clear an aircraft for a visual approach unless the aircraft is and can remain in VFR conditions.

(4) Issues visual approach clearance when the pilot reports sighting the airport or a preceding aircraft which is to be followed.

(5) Provides separation except when visual separation is being applied by the pilot of the aircraft executing the visual approach.

(6) Continues flight following and traffic information until the aircraft is instructed to contact the tower.

(7) Informs the pilot conducting the visual approach of the aircraft class when pertinent traffic is known to be a heavy aircraft.

411. VISUAL SEPARATION

a. Pilot

(1) Acceptance of instructions to follow another aircraft or to provide visual separation from it is an acknowledgment that the pilot will maneuver his/her aircraft as necessary to avoid the other aircraft or to maintain in-trail separation.

(2) If instructed by ATC to follow another aircraft or to provide visual separation from it, promptly notify the controller if you lose sight of that aircraft, are unable to maintain continued visual contact with it, or cannot accept the responsibility for your own separation for any reason.

(3) The pilot also accepts responsibility for wake turbulence separation under these conditions.

b. Controller

(1) Applies visual separation only within a terminal area when a controller has both aircraft in sight or by instructing a pilot who sees the other aircraft to maintain visual separation from it.

412. INSTRUMENT DEPARTURES

a. Pilot

(1) Prior to Departure: Consider the type of terrain and other obstructions on or in the vicinity of the departure airport.

(2) Determine if obstruction avoidance can be maintained visually or that the departure procedure should be followed.

(3) Determine whether a departure procedure and/or SID is available for obstruction avoidance.

(4) At airports where IAPs have not been publishe hence no published departure procedure, determine wh action will be necessary and take such action that wi assure a safe departure.

b. Controller

(1) At locations with airport traffic control servi when necessary, specifies direction of takeoff, turn or ini tial heading to be flown after takeoff.

(2) At locations without airport traffic control servic but within a control zone when necessary to specify dire tion of takeoff/turn or initial heading to be flown, obtain pilot's concurrence that the procedure will allow him t comply with local traffic patterns, terrain, and obstructio avoidance.

(3) Includes established departure procedures as pa of the ATC clearance when pilot compliance is necessary t ensure separation.

413. MINIMUM FUEL ADVISORY

a. Pilot

(1) Advise ATC of your minimum fuel status wh your fuel supply has reached a state where, upon readi destination, you cannot accept any undue delay.

(2) Be aware this is not an emergency situation i merely an advisory that indicates an emergency situa is possible should any undue delay occur.

(3) Be aware a minimum fuel advisory does not im a need for traffic priority.

(4) If the remaining usable fuel supply suggests t need for traffic priority to ensure a safe landing you shou declare an emergency, account low fuel, and report fuel r maining in minutes.

b. Controller

(1) When an aircraft declares a state of minim fuel, relay this information to the facility to whom con jurisdiction is transferred.

(2) Be alert for any occurrence which might delay t aircraft.

414—429. RESERVED

Section 10. NATIONAL SECURITY AND INTERCEPTION PROCEDURES

430. NATIONAL SECURITY

a. National security in the control of air traffic is governed by (FAR—99).

b. All aircraft entering domestic U.S. airspace from points outside must provide for identification prior to entry. To facilitate early aircraft identification of all aircraft in the vicinity of U.S. and international airspace boundaries, Air Defense Identification Zones (ADIZ) have been established. (See PARA—433 - ADIZ BOUNDARIES AND DESIGNATED MOUNTAINOUS AREAS.)

c. Operational requirements for aircraft entering an ADIZ are as follows:

(1) Flight Plan — A flight plan must be filed with an appropriate aeronautical facility for flight in an ADIZ. In the Alaskan DEWIZ (Distant Early Warning Identification Zone), the flight plan must be filed before departure, except as otherwise permitted in FAR—99.13.

(2) Two-way Radio — An operative two-way radio must be available for flight in ADIZ/DEWIZ areas. Exceptions are only as provided in FAR—99.1.

(3) Position Reporting — Normal IFR position reports are required in all ADIZ/DEWIZ areas. In the domestic and coastal ADIZ areas, flights under Defense VFR (DVFR) flight plans must give the estimated time of ADIZ penetration at least 15 minutes prior to penetration. In the coastal ADIZ, inbound foreign aircraft must report at least 1 hour prior to ADIZ penetration. In the Alaskan DEWIZ, DVFR flights must report prior to penetration (correlation of ground filed flight plan data may be required).

(4) Aircraft Position Tolerances:

(a) In a domestic ADIZ tolerance is within plus or minus 5 minutes from the estimated time over a reporting point or point of penetration and within 10 NM from the centerline of an intended track over an estimated reporting point or penetration point.

(b) In a Coastal ADIZ/DEWIZ the tolerance is plus or minus 5 minutes from the estimated time over a reporting point or point of penetration and within 20 NM from the centerline of the intended track over an estimated reporting point or point of penetration.

d. Aircraft operating within an ADIZ may be exempted from the National Security requirements of FAR—99 (except as may be applicable under FAR—99.7) if the aircraft is operating:

(1) Within the 48 contiguous states and the District of Columbia, or within the State of Alaska, and remains within 10 miles of departure point.

(2) In a Coastal or Domestic ADIZ north of 30 degrees North latitude or west of 86 degrees West longitude at a true air speed of less than 180 knots.

(3) In Alaskan DEWIZ at TAS of less than 180 knots while pilot maintains listening watch on appropriate frequency.

(4) Over or within three miles of any island in Hawaiian Coastal ADIZ.

e. Exemptions (except for FAR—99.7) may also be granted by the ARTCC, on a local basis, for some operations within an ADIZ.

f. An Airfiled VFR Flight Plan makes an aircraft subject to interception for positive identification when entering an ADIZ. Pilots are therefore urged to file the required DVFR flight plan either in person or by telephone prior to departure.

g. Special Security Instructions

(1) During defense emergency or air defense emergency conditions, additional special security instructions may be issued in accordance with the Security Control of Air Traffic and Air Navigation Aids (SCATANA) Plan.

(2) Under the provisions of the SCATANA Plan, the military will direct the action to be taken—in regard to landing, grounding, diversion, or dispersal of aircraft and the control of air navigation aids in the defense of the U.S. during emergency conditions.

(3) At the time a portion of all of SCATANA is implemented, ATC facilities will broadcast appropriate instructions received from the military over available ATC frequencies. Depending on instructions received from the military, VFR flights may be directed to land at the nearest available airport, and IFR flights will be expected to proceed as directed by ATC.

(4) Pilots on the ground may be required to file a flight plan and obtain an approval (through FAA) prior to conducting flight operation.

(5) In view of the above, all pilots should guard an ATC or FSS frequency at all times while conducting flight operations.

431. INTERCEPTION PROCEDURES

a. General

(1) Identification intercepts during peacetime operations are vastly different than those conducted under increased states of readiness. Unless otherwise directed by the control agency, intercepted aircraft will be identified by type only. When specific information is required (i.e. markings, serial numbers, etc.) the interceptor aircrew will respond only if the request can be conducted in a safe manner. During hours of darkness or Instrument Meteorological Conditions (IMC), identification of unknown aircraft will be by type only. The interception pattern described below is the typical peacetime method used by air interceptor aircrews. In all situations, the interceptor aircrew will use caution to avoid startling the intercepted aircrew and/or passengers.

b. Intercept phases

(1) Phase One — Approach Phase: During peacetime, intercepted aircraft will be approached from the stern. Generally two interceptor aircraft will be employed to accomplish the identification. The flight leader and his wingman will coordinate their individual positions in conjunction with the ground controlling agency. Their rela-

tionship will resemble a line abreast formation. At night or in IMC, a comfortable radar trail tactic will be used. Safe vertical separation between interceptor aircraft and unknown aircraft will be maintained at all times.

(2) Phase Two — Identification Phase: The intercepted aircraft should expect to visually acquire the lead interceptor and possibly the wingman during this phase in visual meteorological conditions (VMC). The wingman will assume a surveillance position while the flight leader approaches the unknown aircraft. Intercepted aircraft personnel may observe the use of different drag devices to allow for speed and position stabilization during this phase. The flight leader will then initiate a gentle closure toward the intercepted aircraft, stopping at a distance no closer than absolutely necessary to obtain the information needed. The interceptor aircraft will use every possible precaution to avoid startling intercepted aircrew or passengers. Additionally, the interceptor aircrews will constantly keep in mind that maneuvers considered normal to a fighter aircraft may be considered hazardous to passengers and crews of nonfighter aircraft. When interceptor aircrews know or believe that an unsafe condition exists, the identification phase will be terminated. As previously stated, during darkness or IMC identification of unknown aircraft will be by type only. Positive vertical separation will be maintained by interceptor aircraft throughout this phase.

(3) Phase Three — Post Intercept Phase: Upon identification phase completion, the flight leader will turn away from the intercepted aircraft. The wingman wi remain well clear and accomplish a rejoin with his leade

c. Communication interface between interceptor ai crews and the ground controlling agency is essential t ensure successful intercept completion. Flight Safety i paramount. An aircraft which is intercepted by anothe aircraft shall immediately:

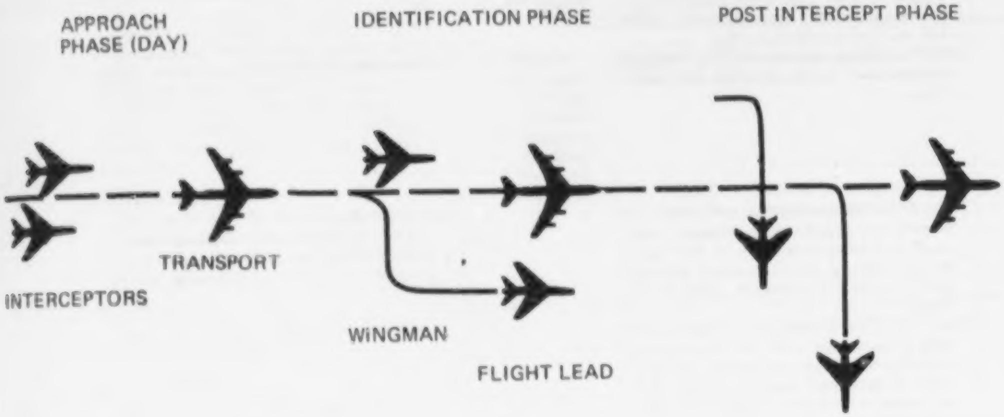
(1) Follow the instructions given by the interceptin aircraft, interpreting and responding to the visual signal

(2) Notify, if possible, the appropriate air traffic ser ices unit.

(3) Attempt to establish radio communication wi the intercepting aircraft or with the appropriate intercep control unit, by making a general call on the emergenc frequency 243.0 MHz and repeating this call on the eme gency frequency 121.5 MHz, if practicable, giving the ide tity and position of the aircraft and the nature of t flight.

(4) If equipped with SSR transponder, select MOD 3/A Code 7700, unless otherwise instructed by the app priate air traffic services unit. If any instructions receiv by radio from any sources conflict with those given by t intercepting aircraft by visual or radio signals, the int cepted aircraft shall request immediate clarification wh continuing to comply with the instructions given by t intercepting aircraft.

INTERCEPTION PATTERNS
FOR IDENTIFICATION OF
INTERCEPTED AIRCRAFT
(TYPICAL)


APPROACH PHASE (DAY)
IDENTIFICATION PHASE
POST INTERCEPT PHASE
TRANSPORT
INTERCEPTORS
WINGMAN
FLIGHT LEAD

Note: During Night/IMC, approach will be from below flight path.

432. INTERCEPTION SIGNALS

INTERCEPTION SIGNALS

Signals initiated by intercepting aircraft and responses by intercepted aircraft (as set forth in ICAO Annex 2 — Appendix A, 2.1)

Series	INTERCEPTING Aircraft Signals	Meaning	INTERCEPTED Aircraft Responds	Meaning
1	DAY — Rocking wings from a position in front and, normally, to the left of intercepted aircraft and, after acknowledgement, a slow level turn, normally to the left, on to the desired heading. NIGHT — Same and, in addition, flashing navigational lights at irregular intervals. *Note 1. — Meteorological conditions or terrain may require the intercepting aircraft to take up a position in front and to the right of the intercepted aircraft and to make the subsequent turn to the right.* *Note 2. — If the intercepted aircraft is not able to keep pace with the intercepting aircraft, the latter is expected to fly a series of race-track patterns and to rock its wings each time it passes the intercepted aircraft.*	You have been intercepted. Follow me. NIGHT — Same and, in addition, flashing navigational lights at irregular intervals.	AEROPLANES: DAY — Rocking wings and following. Understood, will comply. HELICOPTERS: DAY or NIGHT — Rocking aircraft, flashing navigational lights at irregular intervals and following.	
2	DAY or NIGHT — An abrupt break-away manoeuvre from the intercepted aircraft consisting of a climbing turn of 90 degrees or more without crossing the line of flight of the intercepted aircraft.	You may proceed.	AEROPLANES: DAY or NIGHT — Rocking wings. HELICOPTERS: DAY or NIGHT — Rocking aircraft.	Understood, will comply.
3	DAY — Circling aerodrome, lowering landing gear and overflying runway in direction of landing or, if the intercepted aircraft is a helicopter, overflying the helicopter landing area. NIGHT — Same and, in addition, showing steady landing lights.	Land at this aerodrome.	AEROPLANES: DAY — Lowering landing gear, following the intercepted aircraft and, if after overflying the runway landing is considered safe, proceeding to land. NIGHT — Same and, in addition, showing steady landing lights (if carried). HELICOPTERS: DAY or NIGHT — Following the intercepting aircraft and proceeding to land, showing a steady landing light (if carried).	Understood, will comply.

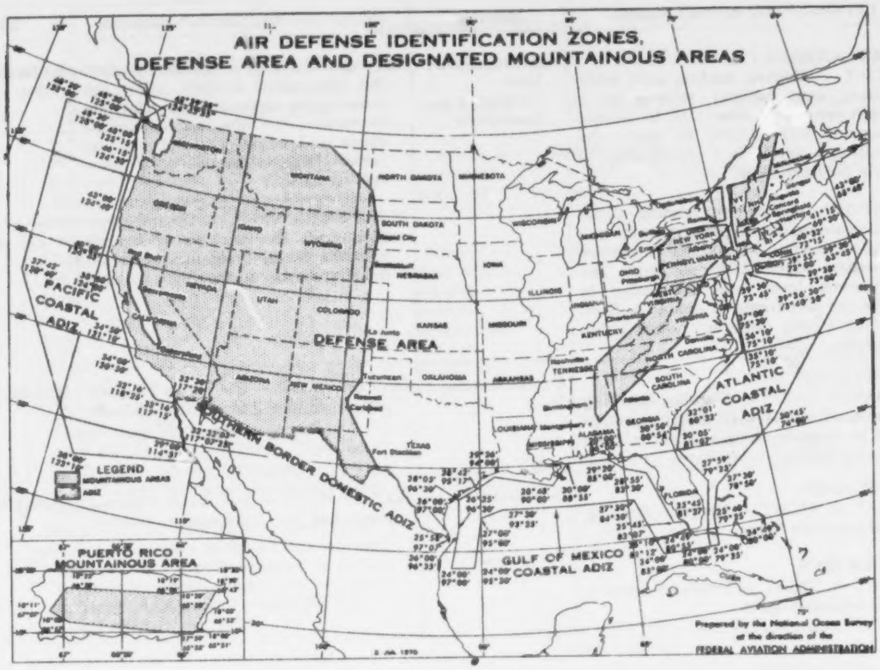
INTERCEPTION SIGNALS

Signals and Responses During Aircraft Intercept

Signals initiated by intercepted aircraft and responses by intercepting aircraft (as set forth in ICAO Annex 2 — Appendix A, 2.2)

eries	INTERCEPTED Aircraft Signals	Meaning	INTERCEPTING Aircraft Responds	Meaning
4	AEROPLANES: DAY — Raising landing gear while passing over landing runway at a height exceeding 300m (1,000 ft) but not exceeding 600m (2,000 ft) above the aerodrome level, and continuing to circle the aerodrome. NIGHT — Flashing landing lights while passing over landing runway at a height exceeding 300m (1,000 ft) but not exceeding 600m (2,000 ft) above the aerodrome level, and continuing to circle the aerodrome. If unable to flash landing lights, flash any other lights available.	Aerodrome you have designated is inadequate.	DAY or NIGHT — If it is desired that the intercepted aircraft follow the intercepting aircraft to an alternate aerodrome, the intercepting aircraft raises its landing gear and uses the Series 1 signals prescribed for intercepting aircraft. If it is decided to release the intercepted aircraft, the intercepting aircraft uses the Series 2 signals prescribed for intercepting aircraft.	Understood, follow me. Understood, you may proceed.
5	AEROPLANES: DAY or NIGHT — Regular switching on and off of all available lights but in such a manner as to be distinct from flashing lights.	Cannot comply.	DAY or NIGHT — Use Series 2 signals prescribed for intercepting aircraft.	Understood.
6	AEROPLANES: DAY or NIGHT — Irregular flashing of all available lights. HELICOPTERS: DAY or NIGHT — Irregular flashing of all available lights.	In distress.	DAY or NIGHT — Use Series 2 signals prescribed for intercepting aircraft.	Understood.

433. ADIZ BOUNDARIES AND DESIGNATED MOUNTAINOUS AREAS


AIR DEFENSE IDENTIFICATION ZONES,
DEFENSE AREA AND DESIGNATED MOUNTAINOUS AREAS
PACIFIC COASTAL ADIZ
DEFENSE AREA
SOUTHERN BORDER DOMESTIC ADIZ
ATLANTIC COASTAL ADIZ
GULF OF MEXICO COASTAL ADIZ
PUERTO RICO MOUNTAINOUS AREA
LEGEND
MOUNTAINOUS AREAS
ADIZ
WASHINGTON
OREGON
IDAHO
MONTANA
WYOMING
NEVADA
UTAH
CALIFORNIA
ARIZONA
NEW MEXICO
COLORADO
NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
KANSAS
OKLAHOMA
TEXAS
MINNESOTA
IOWA
MISSOURI
ARKANSAS
LOUISIANA
WISCONSIN
ILLINOIS
MICHIGAN
INDIANA
OHIO
KENTUCKY
TENNESSEE
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
SOUTH CAROLINA
NORTH CAROLINA
VIRGINIA
PENNSYLVANIA
NEW YORK
Prepared by the National Ocean Survey
at the direction of the
FEDERAL AVIATION ADMINISTRATION

434—439. RESERVED

Chapter 5. EMERGENCY PROCEDURES

Section 1. GENERAL

440. PILOT RESPONSIBILITY AND AUTHORITY

a. The pilot in command of an aircraft is directly responsible for and is the final authority as to the operation of that aircraft. In an emergency requiring immediate action, the pilot in command may deviate from any rule in the FAR, Subpart A, General, and Subpart B, Flight Rules, to the extent required to meet that emergency. (FAR—91.3(b).)

b. If the emergency authority of FAR 91.3.(b) is used to deviate from the provisions of an ATC clearance, the pilot in command must notify ATC as soon as possible and obtain an amended clearance.

c. Unless deviation is necessary under the emergency authority of FAR—91.3, pilots of IFR flights experiencing two-way radio communications failure are expected to adhere to the procedures prescribed under "IFR operations, two-way radio communications failure." (FAR—91.127)

441. EMERGENCY CONDITION - REQUEST ASSISTANCE IMMEDIATELY

a. An emergency can be either a *distress* or *urgency* condition as defined in the Pilot/Controller Glossary. Pilots do not hesitate to declare an emergency when they are faced with *distress* conditions such as fire, mechanical failure, or structural damage. However, some are reluctant to report an *urgency* condition when they encounter situations which may not be immediately perilous, but are potentially catastrophic. An aircraft is in at least an *urgency* condition the moment the pilot becomes doubtful about position, fuel endurance, weather, or any other condition that could adversely affect flight safety. This is the time to ask for help, not after the situation has developed into a *distress* condition.

b. Pilots who become apprehensive for their safety for *any* reason should *request assistance immediately.* Ready and willing help is available in the form of radio, radar, direction finding stations and other aircraft. Delay has caused accidents and cost lives. *Safety is not a luxury! Take action!*

442—449. RESERVED

NOTES

Section 2. EMERGENCY SERVICES AVAILABLE TO PILOTS

450. RADAR SERVICE FOR VFR AIRCRAFT IN DIFFICULTY

a. Radar equipped ATC facilities can provide radar assistance and navigation service (vectors) to VFR aircraft in difficulty when the pilot can talk with the controller, and the aircraft is within radar coverage. Pilots should clearly understand that authorization to proceed in accordance with such radar navigational assistance does not constitute authorization for the pilot to violate FARs. In effect, assistance is provided on the basis that navigational guidance information is advisory in nature, and the responsibility for flying the aircraft safely remains with the pilot.

b. Experience has shown that many pilots who are not qualified for instrument flight cannot maintain control of their aircraft when they encounter clouds or other reduced visibility conditions. In many cases, the controller will not know whether flight into instrument conditions will result from his instructions. To avoid possible hazards resulting from being vectored into IFR conditions, a pilot in difficulty should keep the controller advised of the weather conditions in which he is operating and the weather along the course ahead and observe the following:

(1) If a course of action is available which will permit flight and a safe landing in VFR weather conditions, noninstrument rated pilots should choose the VFR condition rather than requesting a vector or approach that will take them into IFR weather conditions; or

(2) If continued flight in VFR conditions is not possible, the noninstrument rated pilot should so advise the controller and indicating the lack of an instrument rating, declare a *distress* condition, or

(3) If the pilot is instrument rated and current, and the aircraft is instrument equipped, the pilot should so indicate by requesting an IFR flight clearance. Assistance will then be provided on the basis that the aircraft can operate safely in IFR weather conditions.

451. TRANSPONDER EMERGENCY OPERATION

a. When a *distress* or *urgency* condition is encountered, the pilot of an aircraft with a coded radar beacon transponder, who desires to alert a ground radar facility, should squawk MODE 3/A, Code 7700/Emergency and MODE C altitude reporting and then immediately establish communications with the ATC facility.

b. Radar facilities are equipped so that Code 7700 normally triggers an alarm or special indicator at all control positions. Pilots should understand that they might not be within a radar coverage area. Therefore, they should continue squawking Code 7700 and establish radio communications as soon as possible.

452. DIRECTION FINDING INSTRUMENT APPROACH PROCEDURE

a. DF equipment has long been used to locate lost aircraft and to guide aircraft to areas of good weather or to airports. Now at most DF equipped airports, DF instrument approaches may be given to aircraft in a *distress* or *urgency* condition.

b. Experience has shown that most emergencies requiring DF assistance involve pilots with little flight experience. With this in mind, DF approach procedures provide maximum flight stability in the approach by using small turns, and wings-level descents. The DF specialist will give the pilot headings to fly and tell the pilot when to begin descent.

c. DF IAPs are for emergency use only and will not be used in IFR weather conditions unless the pilot has declared a *distress* or *urgency* condition.

d. To become familiar with the procedures and other benefits of DF, pilots are urged to request practice DF guidance and approaches in VFR weather conditions. DF specialists welcome the practice and will honor such requests, workload permitting.

453. INTERCEPT AND ESCORT

a. The concept of airborne intercept and escort is based on the Search and Rescue (SAR) aircraft establishing visual and/or electronic contact with an aircraft in difficulty, providing in-flight assistance, and escorting it to a safe landing. If bailout, crash landing or ditching becomes necessary, SAR operations can be conducted without delay. For most incidents, particularly those occurring at night and/or during instrument flight conditions, the availability of intercept and escort services will depend on the proximity of SAR units with suitable aircraft on alert for immediate dispatch. In limited circumstances, other aircraft flying in the vicinity of an aircraft in difficulty can provide these services.

b. If specifically requested by a pilot in difficulty or if a *distress* condition is declared, SAR coordinators *will* take steps to intercept and escort an aircraft. Steps *may* be initiated for intercept and escort if an *urgency* condition is declared and unusual circumstances make such action advisable.

c. It is the pilot's prerogative to refuse intercept and escort services. Escort services will normally be provided to the nearest adequate airport. Should the pilot receiving escort services continue onto another location after reaching a safe airport, or decide not to divert to the nearest safe airport, the escort aircraft is not obligated to continue and further escort is discretionary. The decision will depend on the circumstances of the individual incident.

454. EMERGENCY LOCATOR TRANSMITTERS

a. GENERAL. Emergency Locator Transmitters (ELTS) are required for most general aviation airplanes (FAR—91.52). ELTs of various types have been developed as a means of locating downed aircraft. These electronic, battery operated transmitters emit a distinctive downward swept audio tone on 121.5 MHz and 243.0 MHz. If "armed" and when subject to crash generated forces they are designed to automatically activate and continuously emit these signals. The transmitters will operate continuously for at least 48 hours over a wide temperature range. A properly installed and maintained ELT can expedite search and rescue operations and save lives.

b. TESTING. ELTs should be tested in accordance with the manufacturer's instructions, preferably in a shielded or screened room to prevent the broadcast of signals which could trigger a false alert. When this cannot be done, aircraft operational testing is authorized on 121.5 MHz and 243.0 MHz as follows:

(1) Tests should be conducted only during the first 5 minutes after any hour. If operational tests must be made outside of this time-frame, they should be coordinated with the nearest FAA Control Tower or FSS.

(2) Tests should be no longer than three audible sweeps.

(3) If the antenna is removable, a dummy load should be substituted during test procedures.

(4) Airborne tests are not authorized.

c. FALSE ALARMS. Caution should be exercised to prevent the inadvertent activation of ELTs in the air or while they are being handled on the ground. Accidental or unauthorized activation will generate an emergency signal that cannot be distinguished from the real thing, leading to expensive and frustrating searches. A false ELT signal could also interfere with genuine emergency transmissions and hinder or prevent the timely location of crash sites. Frequent false alarms could also result in complacency and decrease the vigorous reaction that must be attached to all ELT signals. Numerous cases of inadvertent activation have occurred as a result of aerobatics, hard landings, movement by ground crews and aircraft maintenance. These false alarms can be minimized by monitoring 121.5 MHz and/or 243.0 MHz as follows:

(1) In flight when a receiver is available.

(2) Prior to engine shut down at the end of each flight.

(3) When the ELT is handled during installation or maintenance.

(4) When maintenance is being performed in the vicinity of the ELT.

(5) When the aircraft is moved by a ground crew.

(6) If an ELT signal is heard, turn off the ELT to determine if it is transmitting. If it has been activated, maintenance might be required before the unit is returned to the "ARMED" position.

d. IN-FLIGHT MONITORING AND REPORTING. Pilots are encouraged to monitor 121.5 MHz and/or 243.0 MHz while in-flight to assist in identifying possible emergency ELT transmissions. On receiving a signal, report the following information to the nearest air traffic facility:

(1) Your position at the time the signal was first heard.

(2) Your position at the time the signal was last heard.

(3) Your position at maximum signal strength.

(4) Your flight altitudes and frequency on which the emergency signal was heard - 121.5 MHz or 243.0 MHz. If possible, positions should be given relative to a navigation aid. If the aircraft has homing equipment, provide the bearing to the emergency signal with each reported position.

455. FAA SPONSORED EXPLOSIVES DETECTION (DOG/HANDLER TEAM) LOCATIONS

a. At many of our major airports a program has been established by the FAA to make available explosives detection dog/handler teams. The dogs are trained by the Air Force and the overall program is run by FAA's Office of Civil Aviation Security. Local police departments are the caretakers of the dogs and are allowed to use the dogs in their normal police patrol functions. The local airport however, has first call on the teams' services. The explosives detection teams were established so that no aircraft in flight is more than 1 hour from an airport at which it can be searched if a bomb threat is received. The following list contains those locations that presently have a team in existence. This list will be updated as more teams are established. If you desire this service, notify your company or an FAA facility.

b. Team Locations:

Airport Symbol	Location
ATL	Atlanta, Georgia
BWI	Baltimore, Maryland
BHM	Birmingham, Alabama
BIS	Bismarck, North Dakota
BOS	Boston, Massachusetts
BUF	Buffalo, New York
ORD	Chicago, Illinois
CLE	Cleveland, Ohio
DFW	Dallas, Texas
IAH	Houston, Texas
JAX	Jacksonville, Florida
MCI	Kansas City, Missouri

Airport Symbol	Location
LAX	Los Angeles, California
MEM	Memphis, Tennessee
MIA	Miami, Florida
MSY	New Orleans, Louisiana
PHX	Phoenix, Arizona
PIT	Pittsburgh, Pennsylvania
PDX	Portland, Oregon
SLC	Salt Lake City, Utah
SAN	San Diego, California
SFO	San Francisco, California
SJU	San Juan, Puerto Rico
SEA	Seattle, Washington
GEG	Spokane, Washington
STL	St. Louis, Missouri
TUS	Tucson, Arizona
TUL	Tulsa, Oklahoma

c. If due to weather or other considerations an aircraft with a suspected hidden explosive problem were to land or intended to land at an airport other than those listed in b. above, it is recommended that they call the FAA's Washington Communications Control Center (telephone 202-426-3333, if appropriate) or have an air traffic facility with which you can communicate contact the above center requesting assistance.

456. SEARCH AND RESCUE

a. GENERAL. SAR is a lifesaving service provided through the combined efforts of the federal agencies signatory to the National SAR Plan, and the agencies responsible for SAR within each state. Operational resources are provided by the U.S. Coast Guard, DOD components, the Civil Air Patrol, the Coast Guard Auxiliary, state, county and local law enforcement and other public safety agencies, and private volunteer organizations. Services include search for missing aircraft, survival aid, rescue, and emergency medical help for the occupants after an accident site is located.

b. NATIONAL SEARCH AND RESCUE PLAN. By federal interagency agreement, the National Search and Rescue Plan provides for the effective use of all available facilities in all types of SAR missions. These facilities include aircraft, vessels, pararescue and ground rescue teams, and emergency radio fixing. Under the Plan, the U.S. Coast Guard is responsible for the coordination of SAR in the Maritime Region, and the USAF is responsible in the Inland Region. To carry out these responsibilities, the Coast Guard and the Air Force have established Rescue Coordination Centers (RCCs) to direct SAR activities within their Regions. For aircraft emergencies, distress and urgency information normally will be passed to the appropriate RCC through an ARTCC or FSS.

c. COAST GUARD RESCUE COORDINATION CENTERS

Boston, MA
617-223-3644

New York, NY
212-668-7055

Long Beach, CA
213-590-2225

San Francisco, CA
415-437-3700

Portsmouth, VA
804-398-6231

Miami, FL
305-350-5611

New Orleans, LA
504-589-6225

Cleveland, OH
216-522-3984

St. Louis, MO
314-425-4614

Seattle, WA
206-442-5886

Juneau, AK
907-586-7340

Honolulu, HI
808-546-7109

Kodiak, AK
907-487-5888

San Juan, Puerto Rico
809-722-2943

d. AIR FORCE RESCUE COORDINATION CENTERS

Air Force Rescue Coordination Center - 48 Contiguous States

Scott AFB, Illinois	PHONE
Commercial	618-256-4815
WATS	800-851-3051
AUTOVON	638-4815
FTS	255-4815 or 4810

Alaskan Air Command Rescue Coordination Center - Alaska

Elmendorf AFB, Alaska	PHONE
Commercial	907-227-2131
AUTOVON	752-2426 or 3437 or 4514

e. JOINT RESCUE COORDINATION CENTERS

Honolulu Joint Rescue Coordination Center - Hawaii

HQ 14th Coast Guard District Honolulu.	PHONE
Commercial	808-531-1112
AUTOVON	315-421-4845

f. OVERDUE AIRCRAFT.

(1) ARTCCs and FSSs will alert the SAR system when information is received from any source that an aircraft is in difficulty, overdue, or missing. *A filed flight plan is the most timely and effective indicator that an air-*

craft is overdue. Flight plan information is invaluable to SAR forces for search planning and executing search efforts.

(2) Prior to departure on every flight, local or otherwise, someone at the departure point should be advised of your destination and route of flight if other than direct. Search efforts are often wasted and rescue is often delayed because of pilots who thoughtlessly takeoff without telling anyone where they are going. File a flight plan for *your* safety.

(3) According to the National Search and Rescue Plan, "The life expectancy of an injured survivor decreases as much as 80 percent during the first 24 hours, while the chances of survival of uninjured survivors rapidly diminishes after the first 3 days."

(4) An Air Force Review of 325 SAR missions conducted during a 23-month period revealed that "Time works against people who experience a *distress* but are not on a flight plan, since 36 hours normally pass before family concern initiates an (alert)."

g. VFR SEARCH AND RESCUE PROTECTION.

(1) To receive this valuable protection, *file a VFR Flight Plan* with an FAA FSS. For maximum protection, file only to the point of first intended landing, and refile for each leg to final destination. When a lengthy flight plan is filed, with several stops en route and an ETE to final destination, a mishap could occur on any leg, and unless other information is received, it is probably that no one would start looking for you until 30 minutes after your ETA at your final destination.

(2) If you land at a location other than the intended destination, report the landing to the nearest FAA FSS and advise them of your original destination.

(3) If you land en route and are delayed more than 30 minutes, report this information to the nearest FSS and give them your original destination.

(4) If your ETE changes by 30 minutes or more, report a revised ETE to the nearest FSS and give them your original destination. Remember that if you fail to report within one-half hour after your ETA at final destination, a search will be started to locate you.

(5) It is important that you *close your flight plan IMMEDIATELY AFTER ARRIVAL AT YOUR FINAL DESTINATION WITH THE FSS DESIGNATED WHEN YOUR FLIGHT PLAN WAS FILED. The pilot is responsible for closure of a VFR flight plan; they are not closed automatically.* This will prevent needless search efforts.

(6) The rapidity of rescue on land or water will depend on how accurately your position may be determined. If a flight plan has been followed and your position is on course, rescue will be expedited.

h. SURVIVAL EQUIPMENT.

(1) For flight over uninhabited land areas, it is wise to take and know how to use survival equipment for the type of climate and terrain.

(2) If a forced landing occurs at sea, chances for survival are governed by the degree of crew proficiency in emergency procedures and by the availability and effectiveness of water survival equipment.

i. OBSERVANCE OF DOWNED AIRCRAFT.

(1) Determine if crash is marked with a yellow cross; if so, the crash has already been reported and identified.

(2) If possible, determine type and number of aircraft and whether there is evidence of survivors.

(3) Fix the position of the crash as accurately as possible with reference to a navigational aid. If possible provide geographic or physical description of the area to aid ground search parties.

(4) Transmit the information to the nearest FAA or other appropriate radio facility.

(5) If circumstances permit, orbit the scene to guide in other assisting units until their arrival or until you are relieved by another aircraft.

(6) Immediately after landing, make a complete report to the nearest FAA facility, or Air Force or Coast Guard Rescue Coordination Center. The report can be made by long distance collect telephone.

457—459. RESERVED

GROUND-AIR VISUAL CODE FOR USE BY SURVIVORS

NO.	MESSAGE	CODE SYMBOL
1	Require assistance	V
2	Require medical assistance	X
3	No or Negative	N
4	Yes or Affirmative	Y
5	Proceeding in this direction	↑

IF IN DOUBT, USE INTERNATIONAL SYMBOL SOS

INSTRUCTIONS

1. Lay out symbols by using strips of fabric or parachutes, pieces of wood, stones, or any available material.
2. Provide as much color contrast as possible between material used for symbols and background against which symbols are exposed.
3. Symbols should be at least 10 feet high or larger. Care should be taken to lay out symbols exactly as shown.
4. In addition to using symbols, every effort is to be made to attract attention by means of radio, flares, smoke, or other available means.
5. On snow covered ground, signals can be made by dragging, shoveling or tramping. Depressed areas forming symbols will appear black from the air.
6. Pilot should acknowledge message by rocking wings from side to side.

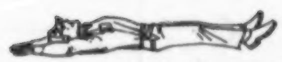
GROUND-AIR VISUAL CODE FOR USE BY GROUND SEARCH PARTIES

NO.	MESSAGE	CODE SYMBOL
1	Operation completed.	LLL
2	We have found all personnel.	$\underline{\underline{\text{LL}}}$
3	We have found only some personnel.	++
4	We are not able to continue. Returning to base.	XX
5	Have divided into two groups. Each proceeding in direction indicated.	⇄
6	Information received that aircraft is in this direction.	—→
7	Nothing found. Will continue search.	NN

"Note: These visual signals have been accepted for international use and appear in Annex 12 to the Convention on International Civil Aviation."

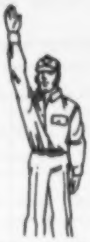
EMERGENCY SERVICES AVAILABLE TO PILOTS

VISUAL EMERGENCY SIGNALS



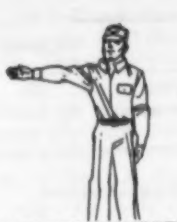
NEED MEDICAL ASSISTANCE—URGENT

Used only when life is at stake



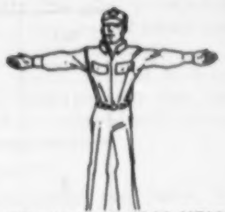
ALL OK—DO NOT WAIT

Wave one arm overhead



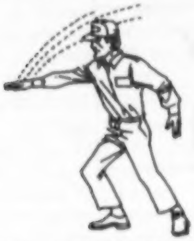
CAN PROCEED SHORTLY—WAIT IF PRACTICABLE

One arm horizontal



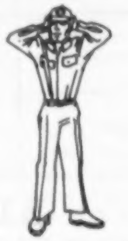
NEED MECHANICAL HELP OR PARTS—LONG DELAY

Both arms horizontal



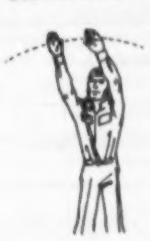
USE DROP MESSAGE

Make throwing motion



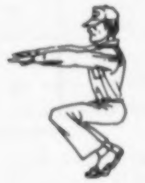
OUR RECEIVER IS OPERATING

Cup hands over ears



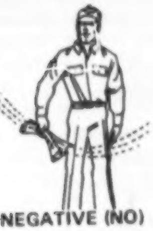
DO NOT ATTEMPT TO LAND HERE

Both arms waved across face



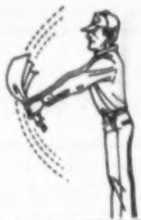
LAND HERE

Both arms forward horizontally, squatting and point in direction of landing—Repeat



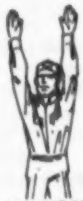
NEGATIVE (NO)

White cloth waved horizontally



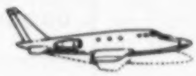
AFFIRMATIVE (YES)

White cloth waved vertically



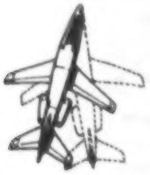
PICK US UP—PLANE ABANDONED

Both arms vertical



AFFIRMATIVE (YES)

Dip nose of plane several times



NEGATIVE (NO)

Fishtail plane

HOW TO USE THEM

If you are forced down and are able to attract the attention of the pilot of a rescue airplane, the body signals illustrated on this page can be used to transmit messages to him as he circles over your location. Stand in the open when you make the signals. Be sure that the background, as seen from the air, is not confusing. Go through the motions slowly and repeat each signal until you are positive that the pilot understands you.

Section 3. DISTRESS AND URGENCY PROCEDURES

460. DISTRESS AND URGENCY COMMUNICATIONS

a. A pilot who encounters a *distress* or *urgency* condition can obtain assistance simply by contacting the air traffic facility or other agency in whose area of responsibility the aircraft is operating, stating the nature of the difficulty, pilot's intentions and assistance desires. *Distress* and *urgency* communications procedures are prescribed by the International Civil Aviation Organization (ICAO), however, and have decided advantages over the informal procedure described above.

b. *Distress* and *urgency* communications procedures discussed in the following paragraphs relate to the use of air ground voice communications.

c. The initial communication, and if considered necessary, any subsequent transmissions by an aircraft in *distress* should begin with the signal MAYDAY, preferably repeated three times. The signal PAN-PAN should be used in the same manner for an *urgency* condition.

d. *Distress* communications have absolute priority over all other communications, and the word MAYDAY commands radio silence on the frequency in use. *Urgency* communications have priority over all other communications except *distress,* and the word PAN-PAN warns other stations not to interfere with *urgency* transmissions.

e. Normally, the station addressed will be the air traffic facility or other agency providing air traffic services, on the frequency in use at the time. If the pilot is not communicating and receiving services, the station to be called will normally be the air traffic facility or other agency in whose area of responsibility the aircraft is operating, on the appropriate assigned frequency. If the station addressed does not respond, or if time or the situation dictates, the *distress* or *urgency* message may be broadcast, or a collect call may be used, addressing "Any Station (Tower)(Radio)(Radar)."

f. The station addressed should immediately acknowledge a *distress* or *urgency* message, provide assistance, coordinate and direct the activities of assisting facilities, and alert the appropriate search and rescue coordinator if warranted. Responsibility will be transferred to another station only if better handling will result.

g. All other stations, aircraft and ground, will continue to listen until it is evident that assistance is being provided. If any station becomes aware that the station being called either has not received a *distress* or *urgency* message, or cannot communicate with the aircraft in difficulty, it will attempt to contact the aircraft and provide assistance.

h. Although the frequency in use or other frequencies assigned by ATC are preferable, the following emergency frequencies can be used for distress or urgency communications, if necessary or desirable:

(1) 121.5 MHz and 243.0 MHz - Both have a range generally limited to line of sight. 121.5 MHz is guarded by direction finding stations and some military and civil aircraft. 243.0 MHz is guarded by military aircraft. Both 121.5 MHz and 243.0 MHz are guarded by military towers, most civil towers, FSSs, and radar facilities. Normally ARTCC emergency frequency capability does not extend to radar coverage limits. If an ARTCC does not respond when called on 121.5 MHz or 243.0 MHz, call the nearest tower or FSS.

(2) 2182 kHz - The range is generally less than 300 miles for the average aircraft installation. It can be used to request assistance from stations in the maritime service. 2182 kHz is guarded by major radio stations serving Coast Guard Rescue Coordination Centers, and Coast Guard units along the sea coasts of the U.S. and shores of the Great Lakes. The call "Coast Guard" will alert all Coast Guard Radio Stations within range. 2182 kHz is also guarded by most commercial coast stations and some ships and boats.

461. OBTAINING EMERGENCY ASSISTANCE

a. A pilot in any *distress* or *urgency* condition should *immediately* take the following action, not necessarily in the order listed, to obtain assistance:

(1) Climb, if possible, for improved communications, and better radar and direction finding detection. However, it must be understood that unauthorized climb or descent under IFR conditions within controlled airspace is prohibited, except as permitted by FAR—91.3(b).

(2) If equipped with a radar beacon transponder (civil) or IFF/SIF (military):

(a) Continue squawking assigned MODE A/3 discrete code/VFR code and MODE C altitude encoding when in radio contact with an air traffic facility or other agency providing air traffic services, unless instructed to do otherwise.

(b) If unable to immediately establish communications with an air traffic facility/agency, squawk MODE A/3, Code 7700/Emergency and MODE C.

(3) Transmit a *distress* or *urgency* message consisting of *as many as necessary* of the following elements, preferably in the order listed:

(a) If distress, MAYDAY, MAYDAY, MAYDAY; if *urgency,* PAN-PAN, PAN-PAN, PAN-PAN.

(b) Name of station addressed.

(c) Aircraft identification and type.

(d) Nature of *distress* or *urgency.*

(e) Weather.

(f) Pilots intentions and request.

(g) Present position, and heading, or if *lost,* last known position, time, and heading since that position.

(h) Altitude or flight level.

(i) Fuel remaining in hours and minutes.

(j) Number of people on board.

(k) Any other useful information.

b. After establishing radio contact, comply with advice and instructions received. Cooperate. Do not hesitate to ask questions or clarify instructions when you do not understand or if you cannot comply with clearance. Assist the ground station to control communications on the frequency in use. Silence interfering radio stations. Do not change frequency or change to another ground station unless absolutely necessary. If you do, advise the ground station of the new frequency and station name prior to the change, transmitting in the blind if necessary. If two-way communications cannot be established on the new frequency, return immediately to the frequency or station where two-way communications last existed.

c. When in a distress condition with bailout, crash landing or ditching imminent, take the following additional actions to assist search and rescue units:

(1) Time and circumstances permitting, transmit as many as necessary of the message elements in PARA—461a(3) and any of the following that you think might be helpful:

(a) ELT status.

(b) Visible landmarks.

(c) Aircraft color.

(d) Number of persons on board.

(e) Emergency equipment on board.

(2) Actuate your ELT if the installation permits.

(3) For bailout, and for crash landing or ditching if risk of fire is not a consideration, set your radio for continuous transmission.

(4) If it becomes necessary to ditch, make every effort to ditch near a surface vessel. If time permits, an FAA facility should be able to get the position of the nearest commercial or Coast Guard vessel from a Coast Guard Rescue Coordination Center.

(5) After a crash landing unless you have good reason to believe that you will not be located by search aircraft or ground teams, it is best to remain with your aircraft and prepare means for signalling search aircraft.

462. DITCHING PROCEDURES

a. A successful aircraft ditching is dependent on three primary factors. In order of importance they are:

(1) Sea conditions and wind.

(2) Type of aircraft.

(3) Skill and technique of pilot.

b. Common oceanographic terminology:

(1) Sea. The condition of the surface that is the result of both waves and swells.

(2) Wave (or Chop). The condition of the surface caused by the local winds.

(3) Swell. The condition of the surface which has been caused by a distance disturbance.

(4) Swell Face. The side of the swell toward the observer. The backside is the side away from the observer. These definitions apply regardless of the direction of swell movement.

(5) Primary Swell. The swell system having the greatest height from trough to crest.

(6) Secondary Swells. Those swell systems of less height than the primary swell.

(7) Fetch. The distance the waves have been driv by a wind blowing in a constant direction, without obstru tion.

(8) Swell Period. The time interval between the pa sage of two successive crests at the same spot in the wate measured in seconds.

(9) Swell Velocity. The speed and direction of th swell with relation to a fixed reference point, measured i knots. There is little movement of water in the horizonta direction. Swells move primarily in a vertical motion, sim lar to the motion observed when shaking out a carpet.

(10) Swell Direction. The direction *from* which swell is moving. This direction is not necessarily the resu of the wind present at the scene. The swell may be movin into or across the local wind. Swells, once set in motio tend to maintain their original direction for as long as the continue in deep water, regardless of changes in wind di rection.

(11) Swell Height. The height between crest a trough, measured in feet. The vast majority of ocean swe are lower than 12 to 15 feet, and swells over 25 feet are n common at any spot on the oceans. Successive swells m differ considerably in height.

c. In order to select a good heading when ditching a aircraft, a basic evaluation of the sea is required. Selecti of a good ditching heading may well minimize damage a could save your life. It can be extremely dangerous to la into the wind without regard to sea conditions; the sw system, or systems, must be taken into consideration. R member one axiom - AVOID THE FACE OF A SWELL.

(1) In ditching parallel to the swell, it makes li difference whether touchdown is on the top of the crest in the trough. It is preferable, however, to land on the t or back side of the swell, if possible. After determini which heading (and its reciprocal) will parallel the sw select the heading with the most into the wind compone

(2) If only one swell system exists, the problem is r atively simple - even with a high, fast system. Unfortuna ly, most cases involve two or more swell systems runn in different directions. With more than one system pres the sea presents a confused appearance. One of the m difficult situations occurs when two swell systems are right angles. For example, if one system is eight feet hi and the other three feet, plan to land parallel to the p mary system, and on the down swell of the second system. If both systems are of equal height, a compromi may be advisable - select an intermediate heading at 45 grees down swell to both systems. When landing dow secondary swell, attempt to touch down on the back s not on the face of the swell.

(3) *If the swell system is formidable, it is conside advisable, in landplanes, to accept more crosswind in or to avoid landing directly into the swell.*

(4) The secondary swell system is often from same direction as the wind. Here, the landing may be m parallel to the primary system, with the wind and seco ary system at an angle. There is a choice to two directi paralleling the primary system. One direction is downw and down the secondary swell, and the other is into wind and into the secondary swell, the choice will depe on the velocity of the wind versus the velocity and hei of the secondary swell.

d. The simplest method of estimating the wind direction and velocity is to examine the windstreaks on the water. Those appear as long streaks up and down wind. Some persons may have difficulty determining wind direction after seeing the streaks on the water. Whitecaps fall forward with the wind but are overrun by the waves thus producing the illusion that the foam is sliding backward. Knowing this, and by observing the direction of the streaks, the wind direction is easily determined. Wind velocity can be estimated by noting the appearance of the whitecaps, foam and wind streaks.

(1) The behavior of the aircraft on making contact with the water will vary within wide limits according to the state of the sea. If landed parallel to a single swell system, the behavior of the aircraft may approximate that to be expected on a smooth sea. If landed into a heavy swell or into a confused sea, the deceleration forces may be extremely great - resulting in breaking up of the aircraft. Within certain limits, the pilot is able to minimize these forces by proper sea evaluation and selection of ditching heading.

(2) When on final approach the pilot should look ahead and observe the surface of the sea. There may be shadows and whitecaps - signs of large seas. Shadows and whitecaps close together indicate short and rough seas. Touchdown in these areas is to be avoided. Select and touchdown in any area (only about 500 feet is needed) where the shadows and whitecaps are not so numerous.

(3) Touchdown should be at the *lowest* speed and rate of descent which permit safe handling and optimum nose up attitude on impact. Once first impact has been made, there is often little the pilot can do to control a landplane.

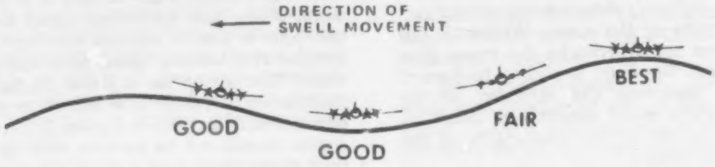
e. Once preditching preparations are completed, the pilot should turn to the ditching heading and commence let-down. The aircraft should be flown low over the water, and slowed down until ten knots or so above stall. At this point, additional power should be used to overcome the increased drag caused by the nose up attitude. When a smooth stretch of water appears ahead, cut power, and touchdown at the best recommended speed as fully stalled as possible. By cutting power when approaching a relatively smooth area, the pilot will prevent overshooting and will touchdown with less chance of planing off into a second uncontrolled landing. Most experienced seaplane pilots prefer to make contact with the water in a semi-stalled attitude, cutting power as the tail makes contact. This technique eliminates the chance of misjudging altitude with a resultant heavy drop in a fully stalled condition. Care must be taken not to drop the aircraft from too high altitude or to balloon due to excessive speed. The altitude above water depends on the aircraft. Over glassy smooth water, or at night without sufficient light, it is very easy, for even the most experienced pilots to misjudge altitude by 50 feet or more. Under such conditions, carry enough power to maintain nine to twelve degrees nose up attitude, and 10 to 20 percent over stalling speed until contact is made with the water. The proper use of power on the approach is of great importance. If power is available on one side only, a little power should be used to flatten the approach; however, the engine should not be used to such an extent that the aircraft cannot be turned against the good engines right down to the stall with a margin of rudder movement available. When near the stall, sudden application of excessive unbalanced power may result in loss of directional control. If power is available on one side only, a slightly higher than normal glide approach speed should be used. This will insure good control and some margin of speed after leveling off without excessive use of power. The use of power in ditching is so important that when it is certain that the coast cannot be reached, the pilot should, if possible, ditch before fuel is exhausted. The use of power in a night or instrument ditching is far more essential than under daylight contact conditions.

(1) If no power is available, a greater than normal approach speed should be used down to the flare-out. This speed margin will allow the glide to be broken early and more gradually, thereby giving the pilot time and distance to feel for the surface - decreasing the possibility of stalling high or flying into the water. When landing parallel to a swell system, little difference is noted between landing on top of a crest or in the trough. If the wings of aircraft are trimmed to the surface of the sea rather than the horizon, there is little need to worry about a wing hitting a swell crest. The actual slope of a swell is very gradual. If forced to land into a swell, touchdown should be made just after passage of the crest. If contact is made on the face of the swell, the aircraft may be swamped or thrown violently into the air, dropping heavily into the next swell. If control surfaces remain intact, the pilot should attempt to maintain the proper nose above the horizon attitude by rapid and positive use of the controls.

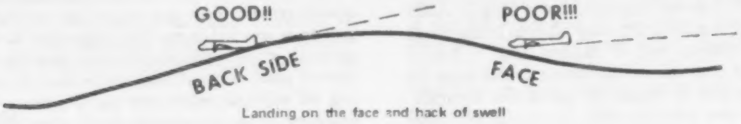
f. After Touchdown: In most cases drift, caused by crosswind can be ignored; the forces acting on the aircraft after touchdown are of such magnitude that drift will be only a secondary consideration. If the aircraft is under good control, the "crab" may be kicked out with rudder just prior to touchdown. This is more important with high wing aircraft, for they are laterally unstable on the water in a crosswind and may roll to the side in ditching.

NOTE.— This information has been extracted from Appendix H of the "National Search And Rescue Manual."

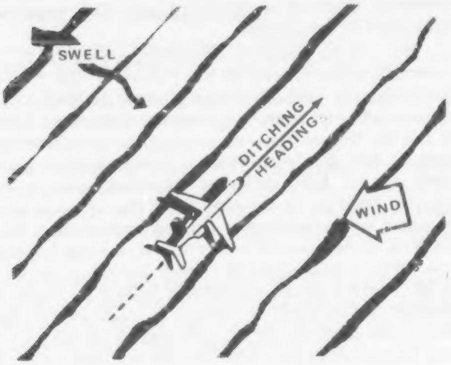
WIND-SWELL-DITCH HEADING SITUATIONS


DIRECTION OF
SWELL MOVEMENT
GOOD
GOOD
FAIR
BEST

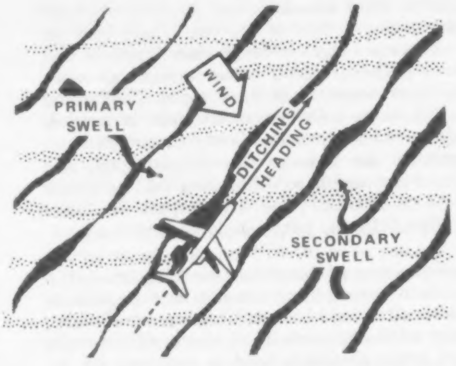
Landing parallel to the major swell


GOOD!!
POOR!!!
BACK SIDE
FACE

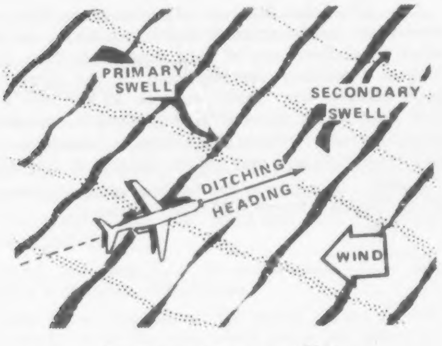
Landing on the face and back of swell


SWELL
DITCHING
HEADING
WIND

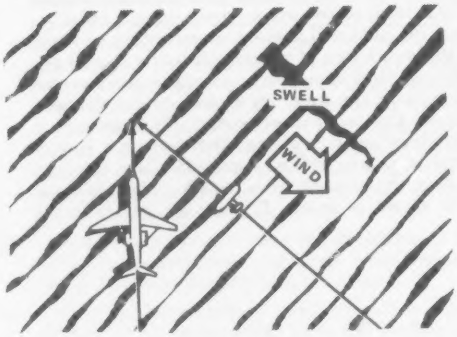
Single Swell System · Wind 15 knots


PRIMARY
SWELL
WIND
DITCHING
HEADING
SECONDARY
SWELL

Double Swell System · Wind 15 knots


PRIMARY
SWELL
SECONDARY
SWELL
DITCHING
HEADING
WIND

Double Swell System · Wind 30 knots



Wind · 50 knots

Aircraft with low landing speeds · land into the wind.

Aircraft with high landing speeds · choose compromise heading between wind and swell.

Both · Land on back side of swell.

463. SPECIAL EMERGENCY (AIR PIRACY)

a. A special emergency is a condition of air piracy, or other hostile act by a person(s) aboard an aircraft, which threatens the safety of the aircraft or its passengers.

b. The pilot of an aircraft reporting a special emergency condition should:

(1) If circumstances permit, apply *distress or urgency* radio-telephony procedures (see PARA—460). Include the details of the special emergency.

(2) If circumstances do not permit the use of prescribed *distress* or *urgency* procedures, transmit:

(a) On the air/ground frequency in use at the time.

(b) As many as possible of the following elements spoken distinctly and in the following order:

1. Name of the station addressed (time and circumstances permitting).

2. The identification of the aircraft and present position.

3. The nature of the special emergency condition and pilot intentions (circumstances permitting).

4. If unable to provide this information, use code words and/or transponder as follows: state "TRANSPONDER SEVEN FIVE ZERO ZERO". Meaning: "I am being hijacked/forced to a new destination"; and/or use Transponder Setting MODE 3/A, Code 7500.

NOTE.— Code 7500 will never be assigned by ATC without prior notification from the pilot that his aircraft is being subjected to unlawful interference. The pilot should refuse the assignment of Code 7500 in any other situation and inform the controller accordingly. Code 7500 will trigger the special emergency indicator in all radar ATC facilities.

c. Air traffic controllers will acknowledge and confirm receipt of transponder Code 7500 by asking the pilot to verify it. If the aircraft is not being subjected to unlawful interference, the pilot should respond to the query by broadcasting in the clear that he is not being subjected to unlawful interference. Upon receipt of this information, the controller will request the pilot to verify the code selection depicted in the code selector windows in the transponder control panel and change the code to the appropriate setting. If the pilot replies in the affirmative or does not reply, the controller will not ask further questions but will flight follow, respond to pilot requests and notify appropriate authorities.

d. If it is possible to do so without jeopardizing the safety of the flight, the pilot of a hijacked passenger aircraft, after departing from the cleared routing over which the aircraft was operating, will attempt to do one or more of the following things, insofar as circumstances may permit:

(1) Maintain a true airspeed of no more than 400 knots, and preferably an altitude of between 10,000 and 25,000 feet.

(2) Fly a course toward the destination which the hijacker has announced.

e. If these procedures result in either radio contact or air intercept, the pilot will attempt to comply with any instructions received which may direct him to an appropriate landing field.

464. FUEL DUMPING

a. Should it become necessary to dump fuel, the pilot should immediately advise ATC. Upon receipt of information that an aircraft will dump fuel, ATC will broadcast or cause to be broadcast immediately and every 3 minutes thereafter the following on appropriate ATC and FSS radio frequencies:

EXAMPLE:

> ATTENTION ALL AIRCRAFT — FUEL DUMPING IN PROGRESS OVER — (location) AT (altitude) BY (type aircraft) (flight direction).

b. Upon receipt of such a broadcast, pilots of aircraft affected, which are not on IFR flight plans or special VFR clearances, should clear the area specified in the advisory. Aircraft on IFR flight plans or special VFR clearances will be provided specific separation by ATC. At the termination of the fuel dumping operation, pilots should advise ATC. Upon receipt of such information, ATC will issue, on the appropriate frequencies, the following:

EXAMPLE:

> ATTENTION ALL AIRCRAFT — FUEL DUMPING BY — (type aircraft) — TERMINATED.

465—469. RESERVED

NOTES

Section 4. TWO-WAY RADIO COMMUNICATIONS FAILURE

470. TWO-WAY RADIO COMMUNICATIONS FAILURE

a. It is virtually impossible to provide regulations and procedures applicable to all possible situations associated with two-way radio communications failure. During two-way radio communications failure, when confronted by a situation not covered in the regulation, pilots are expected to exercise good judgment in whatever action they elect to take. Should the situation so dictate they should not be reluctant to use the emergency action contained in FAR—91.3(b).

b. Whether two-way communications failure constitutes an emergency depends on the circumstances, and in any event, it is a determination made by the pilot. FAR—91.3(b) authorizes a pilot to deviate from any rule in Subparts A and B to the extent required to meet an emergency.

c. In the event of two-way radio communications failure, ATC service will be provided on the basis that the pilot is operating in accordance with FAR—91.127. A pilot experiencing two-way communications failure should (unless emergency authority is exercised) comply with FAR—91.127 quoted below. Capitalization and examples added for emphasis.

"91.127 IFR operations; two-way radio communications failure."

(1) General. Unless otherwise authorized by ATC, each pilot who has two-way radio communications failure when operating under IFR shall comply with the rules of this section.

(2) VFR conditions. If the failure occurs in VFR conditions, or if VFR conditions are encountered after the failure, each pilot shall continue the flight under VFR and land as soon as practicable.

NOTE.— This procedure also applies when two-way radio failure occurs while operating in Positive Control Airspace (PCA). The primary objective of this provision in FAR—91.127 is to preclude extended IFR operation in the ATC system in VFR weather conditions. Pilots should recognize that operation under these conditions may unnecessarily as well as adversely affect other users of the airspace, since ATC may be required to reroute or delay other users in order to protect the failure aircraft. However, it is not intended that the requirement to "land as soon as practicable" be construed to mean "as soon as possible." The pilot retains his prerogative of exercising his best judgment and is not required to land at an unauthorized airport, at an airport unsuitable for the type of aircraft flown, or to land only minutes short of his destination.

(3) IFR conditions. If the failure occurs in IFR conditions, or if paragraph (b) of this section cannot be complied with, each pilot shall continue the flight according to the following:

(a) Route.

1. By the route assigned in the last ATC clearance received;

2. If being radar vectored, by the direct route from the point of radio failure to the fix, route, or airway specified in the vector clearance;

3. In the absence of an assigned route, by the route that ATC has advised may be expected in a further clearance; or

4. In the absence of an assigned route or a route that ATC has advised may be expected in a further clearance by the route filed in the flight plan.

(b) Altitude. At the HIGHEST of the following altitudes or flight levels FOR THE ROUTE SEGMENT BEING FLOWN:

1. The altitude or flight level assigned in the last ATC clearance received;

2. The minimum altitude (converted, if appropriate, to minimum flight level as prescribed in FAR 91.81. (c)) for IFR operations; or

3. The altitude or flight level ATC has advised may be expected in a further clearance.

NOTE.— The intent of the rule is that a pilot who has experienced two-way radio failure should, during any segment of his route, fly at the appropriate altitude specified in the rule for that particular segment. The appropriate altitude is whichever of the three is highest in each given phase of flight: (1) the altitude or flight level last assigned; (2) the MEA or (3) the altitude or flight level the pilot has been advised to expect in a further clearance.

EXAMPLE:

A pilot with two-way radio failure had an assigned altitude of 7,000 feet, and while en route comes to a route segment for which the MEA was 9,000 feet. He would climb to 9,000 feet at the time or place where it became necessary to comply with the 9,000 feet MEA. (See FAR—91.119(b).) If later, while still proceeding to his destination, the MEA dropped from 9,000 feet to 5,000 feet, he would descend to *7,000 feet* (the last assigned altitude), because that altitude is *higher* than the MEA.

EXAMPLE:

The MEA between **A** and **B** —5,000 feet. The MEA between **B** and **C** —5,000 feet. The MEA between **C** and **D** —11,000 feet. The MEA between **D** and **E** —7,000 feet. A pilot had been cleared via **A, B, C, D,** to **E.** While flying between A and B his assigned altitude was 6,000 feet and he was told to expect a clearance to 8,000 feet at **B.** Prior to receiving the higher altitude assignment, he experienced two-way failure. The pilot would maintain 6,000 to **B,** then climb to 8,000 feet (the altitude he was advised to expect.) He would maintain 8,000 feet, then climb to 11,000 at **C,** or prior to **C** if necessary to comply with an MCA at **C.** (FAR—91.119(b)). Upon reaching **D,** the pilot would descend to *8,000 feet* (even though the MEA was 7,000 feet), as 8,000 was the highest of the altitude situations stated in the rule (FAR—91.127).

(c) Leave holding fix/clearance limit.

1. If an EFC time has been received, leave the clearance limit/holding fix at that time and proceed to and

hold, if necessary, at the holding pattern depicted for the IAP or, if none is depicted, at the fix from which the approach begins. Any additional delay information the pilot has received should not be used or considered in the application of two-way communications failure procedures.

2. If an EFC time has not been received, the pilot is expected to proceed to and hold, if necessary, at the holding pattern depicted for the IAP or, if none is depicted, at the fix from which the approach begins. If more than one approach fix is available, it is pilot choice and ATC protects airspace at all of them.

NOTE.— The phrase *fix from which the approach begins* means any initial approach fix, or point at which the procedure track symbol begins, as depicted on the plan view of the instrument approach procedure.

(d) Descent for approach.

1. Begin descent from the en route altitude or flight level upon reaching the fix from which the approach begins, but not before the estimated time of arrival shown on the flight plan as amended with ATC.

2. If holding is necessary at the radio fix to be used for the approach at the destination airport, holding and descent to the initial approach altitude shall be accomplished in a holding pattern in accordance with the pattern depicted on the approach chart. If no holding pattern is depicted, holding and descent will be accomplished in a holding pattern on the side of the final approach course on which the procedure turn is described.

471. TRANSPONDER OPERATION DURING TWO-WAY COMMUNICATIONS FAILURE

a. If a pilot of an aircraft with a coded radar beacon transponder experiences a loss of two-way radio capability he should:

(1) Adjust his transponder to reply on MODE A/3, Code 7700 for a period of 1 minute.

(2) Then change to Code 7600 and remain on 7600 for a period of 15 minutes or the remainder of the flight, whichever comes first.

(3) Repeat steps (1) and (2) as practicable.

b. The pilot should understand that he may not be in an area of radar coverage.

472. REESTABLISHING RADIO CONTACT

a. In addition to monitoring the NAVAID voice feature, the pilot should attempt to reestablish communications by attempting contact:

(1) on the previously assigned frequency, or

(2) with an FSS or *ARINC.

b. If communcations are established with an FSS or ARINC, the pilot should advise that radio communications on the previously assigned frequency has been lost giving the aircraft's position, altitude, last assigned frequency and then request further clearance from the controlling facility. The preceding does not preclude the use of 121.5 MHz. There is no priority on which action should be attempted first. If the capability exists, do all at the same time.

NOTE.— *AERONAUTICAL RADIO/INCORPORATED (ARINC) - is a commercial communications corporation which designs, constructs, operates, leases or otherwise engages in radio activities serving the aviation community. ARINC has the capability of relaying information to/from ATC facilities throughout the country.

473—499. RESERVED

Chapter 6. SAFETY OF FLIGHT

Section 1. METEOROLOGY

500. NATIONAL WEATHER SERVICE AVIATION PRODUCTS

a. Weather service to aviation is a joint effort of the National Weather Service (NWS), the Federal Aviation Administration (FAA), the military weather services, and other aviation oriented groups and individuals. The NWS maintains an extensive surface and upper air, as well as radar weather observing program, a nationwide aviation weather forecasting service, and also provides pilot briefing service. The majority of pilot briefing services are provided by FAA personnel at Flight Service Stations (FSSs). Weather observations are taken each hour or more at over 600 locations in the U.S. by NWS and FAA personnel. This includes 4 unmanned Automatic Observation Stations (AUTOB) that derive and report cloud height and visibility values in a manner different from the conventional weather report. A decode key for AUTOB reports is contained at the end of this section. These stations are located at Winslow, Arizona (INW), Sandberg, California (SDB), Del Rio, Texas (DRT), and Wendover, Utah (ENV). A more complex system, the Automated Weather Observing System (AWOS) is planned which will cost-effectively automate most surface weather observations. See PARA—509 for a description of this system.

b. Aviation forecasts are prepared by 52 Weather Service Forecast Offices (WSFOs). These offices prepare and distribute approximately 500 terminal forecasts 3 times daily for specific airports in 50 states and the Caribbean (4 times daily in Alaska and Hawaii). These forecasts, which are amended as required, are valid for 24 hours. The last 6 hours are given in categorical outlook terms as described in PARA—505. WSFOs also prepare a total of over 300 route forecasts and 39 synopses for Pilots Automatic Telephone Weather Answering Service (PATWAS), Transcribed Weather Broadcast (TWEB), and briefing purposes. The route forecasts that are issued during the morning and mid-day are valid for 12 hours while the evening issuance is valid for 18 hours. A new centralized aviation forecast program originating from the National Aviation Weather Advisory Unit (NAWAU) in Kansas City was implemented in November 1982. In the conterminous U.S., all In-flight Advisories (SIGMETs, convective SIGMETs, and AIRMETs) and all Area Forecasts (6 areas) are now issued by NAWAU. The Area Forecasts are prepared 3 times a day in the conterminous states (4 times in Hawaii), and amended as required, while In-flight Advisories are issued only when conditions warrant. (See PARA—504.) Winds aloft forecasts are provided for 176 locations in the 48 contiguous states and 21 in Alaska for flight planning purposes. (Winds aloft forecasts for Hawaii are prepared locally). All of the aviation weather forecasts are given wide distribution through the Weather Message Switching Center in Kansas City (WMSC).

501. FAA WEATHER SERVICES

a. The FAA maintains a nationwide network of Flight Service Stations (FSSs) to serve the weather needs of pilots. In addition, NWS meteorologists are assigned to most Air Route Traffic Control Centers (ARTCCs) as part of the Center Weather Service Unit (CWSU). They provide advisory service and short-term forecasts (nowcasts) to support the needs of the FAA and other users of the system.

b. Preflight weather information sources are as follows: The A.M. Weather telecast on PBS television networks is a jointly sponsored 15-minute weather program designed for pilots. It is broadcast Monday through Friday mornings. Check TV listings in your area for station and exact times. The Transcribed Weather Broadcast (TWEB), telephone access to the TWEB (TEL-TWEB), Pilots Automatic Telephone Answering Service (PATWAS), and Telephone Aviation Briefing System (TABS) provide continously updated recorded weather information for short or local flights. Separate paragraphs in this section give additional information regarding these services. The Voice Response System (VRS) is a system being tested in the Washington, D.C. and Columbus, Ohio areas whereby a limited weather data-base is accessed through the use of a TOUCH-TONE® telephone. FAA is testing this system as part of a wide ranging program to improve and automate weather briefings for general aviation pilots. A VRS information pamphlet is available by writing to VRS, DOT/FAA Technical Center, ACT-110, Atlantic City, NJ 08405. You can refer to the Special Notices section of the Notices to Airmen (Class II) publication for latest information on this system. The primary source of preflight weather briefings, of course, is an individual briefing obtained from a briefer at the FSS or NWS. These briefings, which are tailored to your specific flight, are available 24 hours a day through the local FSS or through the use of toll free lines (INWATS). Numbers for these services can be found in the Airport/Facility Directory under the FSS and National Weather Service Telephone Numbers section, and the DOT, Federal Aviation Administration or Department of Commerce, National Weather Service listing under U.S. Government in your local telephone directory. See PARA—502 for the types of preflight briefings available and the type of information contained in each.

c. In-flight weather information is available from any FSS within radio range. See PARA-506 through PARA—508 for information on broadcasts. En route Flight Advisory Service (EFAS) is provided to serve the nonroutine weather needs of pilots in flight. See PARA—503 for details on this service.

502. PREFLIGHT BRIEFING

a. Flight Service Stations (FSSs) are the primary source for obtaining preflight briefings and in-flight weather information. In some locations, the Weather Service Office (WSO) provides preflight briefings on a limited basis. Flight Service Specialists are qualified and certificated by the NWS as Pilot Weather Briefers. They are not authorized to make original forecasts, but are authorized to translate and interpret available forecasts and reports directly into terms describing the weather conditions which you can expect along your flight route and at your destination. Available aviation weather reports and forecasts are displayed at each FSS and WSO. Some of the larger FSSs provide a separate display for pilot use. Pilots should feel free to use these self briefing displays where available, or to ask for a briefing or assistance from the specialist on duty. Three basic types of preflight briefings are available to serve your specific needs. These are: Standard Briefing, Abbreviated Briefing, and Outlook Briefing. You should specify to the briefer the type of briefing you want, along with appropriate background information. (Refer to PARA—290 for items that are required.) This will enable the briefer to tailor the information to your intended flight. The following paragraphs describe the types of briefings available and the information provided in each.

b. STANDARD BRIEFING—You should request a Standard Briefing any time you are planning a flight and you have not received a previous briefing or have not received preliminary information through mass dissemination media; e.g., TWEB, PATWAS, VRS, etc. The briefer will automatically provide the following information in the sequence listed, except as noted, when it is applicable to your proposed flight.

(1) Adverse Conditions—Significant meteorological and aeronautical information that might influence the pilot to alter the proposed flight, e.g., hazardous weather conditions, runway closures, NAVAID outages, etc.

(2) VFR Flight Not Recommended—When VFR flight is proposed and sky conditions or visibilities are present or forecast, surface or aloft, that in the briefer's judgement would make flight under visual flight rules doubtful, the briefer will describe the conditions, affected locations, and use the phrase "*VFR flight is not recommended.*" This recommendation is advisory in nature. The final decision as to whether the flight can be conducted safely rests solely with the pilot.

(3) Synopsis—A brief statement describing the type, location and movement of weather systems and/or air masses which might affect the proposed flight.

NOTE— These first 3 elements of a briefing may be combined in any order when the briefer believes it will help to more clearly describe conditions.

(4) Current Conditions—Reported weather conditions applicable to the flight will be summarized from all available sources; e.g., SAs, PIREPs, RAREPs. This element will be omitted if the proposed time of departure is beyond two hours, unless the information is specifically requested by the pilot.

(5) En Route Forecast—Forecast en route conditions for the proposed route are summarized in logical order; i.e., departure-climbout, en route, and descent.

(6) Destination Forecast—The destination forecast for the planned ETA. Any significant changes within 1 hour before and after the planned arrival are included.

(7) Winds Aloft—Forecast winds aloft will be summarized for the proposed route. The briefer will interpolate wind directions and speeds between levels and stations as necessary to provide expected conditions at planned altitudes.

(8) Notices to Airmen (NOTAMs)—

(a) Available NOTAM(D) information pertinent to the proposed flight.

(b) NOTAM(L) information pertinent to the departure and/or local area, if available, and pertinent FDC NOTAMs within approximately 400 miles of the FSS providing the briefing.

NOTE 1— NOTAM information may be combined with current conditions when the briefer believes it is logical to do so.

NOTE 2— NOTAM(D) information and FDC NOTAMs which have been published in the Notices to Airmen (Class II) Publication are not included in pilot briefings unless a review of this publication is specifically requested by the pilot. For complete flight information you are urged to review Class II NOTAMs and the Airport/Facility Directory in addition to obtaining a briefing.

(9) ATC Delays—Any known ATC delays and flow control advisories which might affect the proposed flight.

(10) Pilots may obtain the following from FSS briefers upon request:

(a) Information on military training routes and MOA activity within 100 NM of facility conducting briefing.

NOTE— For flights beyond 100 miles, pilots are encouraged to request updated information from en route FSSs.

(b) A review of the Notices to Airmen Publicatio (Class II NOTAMs) for pertinent NOTAMs and Special Notices.

(c) Approximate density altitude data.

(d) Information regarding such items as air traffic services and rules, customs/immigration procedures, ADIZ rules, search and rescue, etc.

(e) Other assistance as required.

c. ABBREVIATED BRIEFING— Request an Abbreviated Briefing when you need information to supplement mass disseminated data, update a previous briefing, or when you need only one or two specific items. Provide the briefer with appropriate background information, the time you received the previous information, and/or the specific items needed. You should indicate the source of the information already received so that the briefer can limit the briefing to the information that you have not received, and/or appreciable changes in meteorological conditions since your previous briefing. To the extent possible, the briefer will provide the information in the sequence shown for a Standard Briefing. If you request only one or two specific items, the briefer will advise you if adverse conditions are present or forecast. Details on these conditions will be provided at your request.

d. OUTLOOK BRIEFING— You should request an Outlook Briefing whenever your proposed time of departure is six or more hours from the time of the briefing. The briefer will provide available forecast data applicable to the proposed flight. This type of briefing is provided for planning purposes only. You should obtain a Standard or Abbreviated Briefing prior to departure in order to obtain such items as current conditions, updated forecasts, winds aloft and NOTAMs.

e. INFLIGHT BRIEFING— You are encouraged to obtain your preflight briefing by telephone or in person before departure. In those cases where you need to obtain a preflight briefing or an update to a previous briefing by radio, you should contact the nearest FSS to obtain this information. After communications have been established, advise the specialist of the type briefing you require and provide appropriate background information. You will be provided information as specified in the above paragraphs, depending on the type briefing requested. In addition, the specialist will recommend shifting to the flight watch frequency when conditions along the intended route indicate that it would be advantageous to do so.

f. Following any briefing, feel free to ask for any information that you or the briefer may have missed. It helps to save your questions until the briefing has been completed. This way, the briefer is able to present the information in a logical sequence, and lessens the chance of important items being overlooked.

503. EN ROUTE FLIGHT ADVISORY SERVICE (EFAS)

a. EFAS is a service specifically designed to provide en route aircraft with timely and meaningful weather advisories pertinent to the type of flight intended, route of flight and altitude. It is normally available throughout the conterminous U.S. from 6 a.m. to 10 p.m. at a service criterion of 5,000 feet above ground level. EFAS is provided by specially trained specialists from selected FSSs controlling one or more remote communications outlets covering a large geographical area. All communications are conducted on the designated EFAS frequency, 122.0 MHz.

b. To contact a flight watch facility on 122.0 MHz use the name of the VOR nearest to your location, followed by the words "FLIGHT WATCH'. The flight watch facility that provides service to that area will respond to your call by the facility name. If you know in whose flight watch area you are flying, you can use the name of the facility, followed by an abbreviated position report to assist the operator in selecting the appropriate communications outlet.

EXAMPLE:

CHADRON FLIGHT WATCH, CESSNA ONE TWO THREE FOUR KILO OVER.

EXAMPLE:

DENVER FLIGHT WATCH, CESSNA ONE TWO THREE FOUR KILO TWENTY EAST OF CHADRON VOR OVER.

c. En route Flight Advisory Service is provided by the following FSSs:

Albuquerque, NM
Amarillo, TX
Atlanta, GA
Birmingham, AL
Bridgeport, CT
Buffalo, NY
Charleston, SC
Charleston, WV
Chicago, IL
Denver, CO
Des Moines, IA
Detroit, MI
El Paso, TX
Fort Worth, TX
Grand Forks, ND
Great Falls, MT
Houston, TX
Huron, SD
Indianapolis, IN
Jackson, MS
Kansas City, MO
Las Vegas, NV
Los Angeles, CA
Memphis, TN
Miami, FL
Minneapolis, MN
Montpelier, VT
New Orleans, LA
Oakland, CA
Oklahoma City, OK
Omaha, NE
Phoenix, AZ
Pittsburgh, PA
Portland, OR
Raleigh, NC
Saint Louis, MO
Salt Lake City, UT
San Antonio, TX
Seattle, WA
Teterboro, NJ
Walla Walla, WA
Washington, DC

d. EFAS is not intended to be used for filing or closing flight plans, position reporting, to get a complete preflight briefing, or to obtain random weather reports and forecasts. In such instances, the flight watch specialist will provide the name and radio frequency of the FSS to contact for such services. Pilot participation is essential to the success of EFAS through a continuous exchange of information on winds, turbulence, visibility, icing, etc., between pilots in-flight and flight watch specialists on the ground. Pilots are encouraged to report good as well as bad and expected as well as unexpected flight conditions to flight watch facilities.

504. IN-FLIGHT WEATHER ADVISORIES

a. The NWS issues in-flight weather advisories designated as convective SIGMETs (WST), SIGMETs (WS), or AIRMETs (WA). These advisories are issued individually, however, the information contained in them is also included in relevant portions of the Area Forecast (FA). When these advisories are issued subsequent to the FA, they automatically amend appropriate portions of the FA until the FA itself has been amended. In-flight advisories serve to notify en route pilots of the possibility of encountering hazardous flying conditions which may not have been forecast at the time of the preflight briefing. Whether or not the condition described is potentially hazardous to a particular flight is for the pilot to evaluate on the basis of experience and the operational limits of the aircraft.

b. Convective SIGMETs are issued for the following phenomena:

(1) Tornadoes.

(2) Lines of thunderstorms.

(3) Embedded thunderstorms.

(4) Thunderstorm areas greater than or equal to thunderstorm intensity level 4 with an area coverage of 4/10 (40 percent) or more. (See RADAR WEATHER ECHO INTENSITY LEVELS in Pilot/Controller Glossary.)

(5) Hail greater than or equal to 3/4 inch diameter.

NOTE.— Since thunderstorms are the reason for issuing the convective SIGMET, severe or greater turbulence, severe icing, and low-level wind shear (gust fronts, etc) are implied and will not be specified in the advisory.

c. CONVECTIVE SIGMET BULLETINS:

(1) Three Convective SIGMET bulletins, each covering a specified geographic area, are issued. These areas are the Eastern (E), Central (C), and Western (W) U.S. These bulletins are issued on a scheduled basis, hourly at 55 minutes past the hour (H+55), and as special bulletins on an unscheduled basis. The boundaries that separate the Eastern and Central, and the Central and Western U.S. are 87 and 107 degrees West, respectively. (See following figure for VORs and major locations used as reference points for the In-Flight Weather Advisory messages.)

(2) Each of the Convective SIGMET bulletins will be:

(a) Made up of one or more individually numbered Convective SIGMETs,

(b) Valid for 1 hour, and

(c) Removed from system automatically at 40 minutes past the hour (H+40).

d. SIGMETs within the conterminous U.S. are issued by the National Aviation Weather Advisory Unit (NAWAU) for the following hazardous weather phenomena:

(1) Severe and extreme turbulence.

(2) Severe icing.

(3) Widespread duststorms, sandstorms, or volcanic ash lowering visibilities to below three miles.

e. AIRMETs within the conterminous U.S. are issued by the NAWAU for the following weather phenomena which are potentially hazardous to aircraft:

(1) Moderate icing.

(2) Moderate turbulence.

(3) Sustained winds of 30 knots or more at the surface.

(4) Widespread area of ceilings less than 1,000 feet and/or visibility less than three miles.

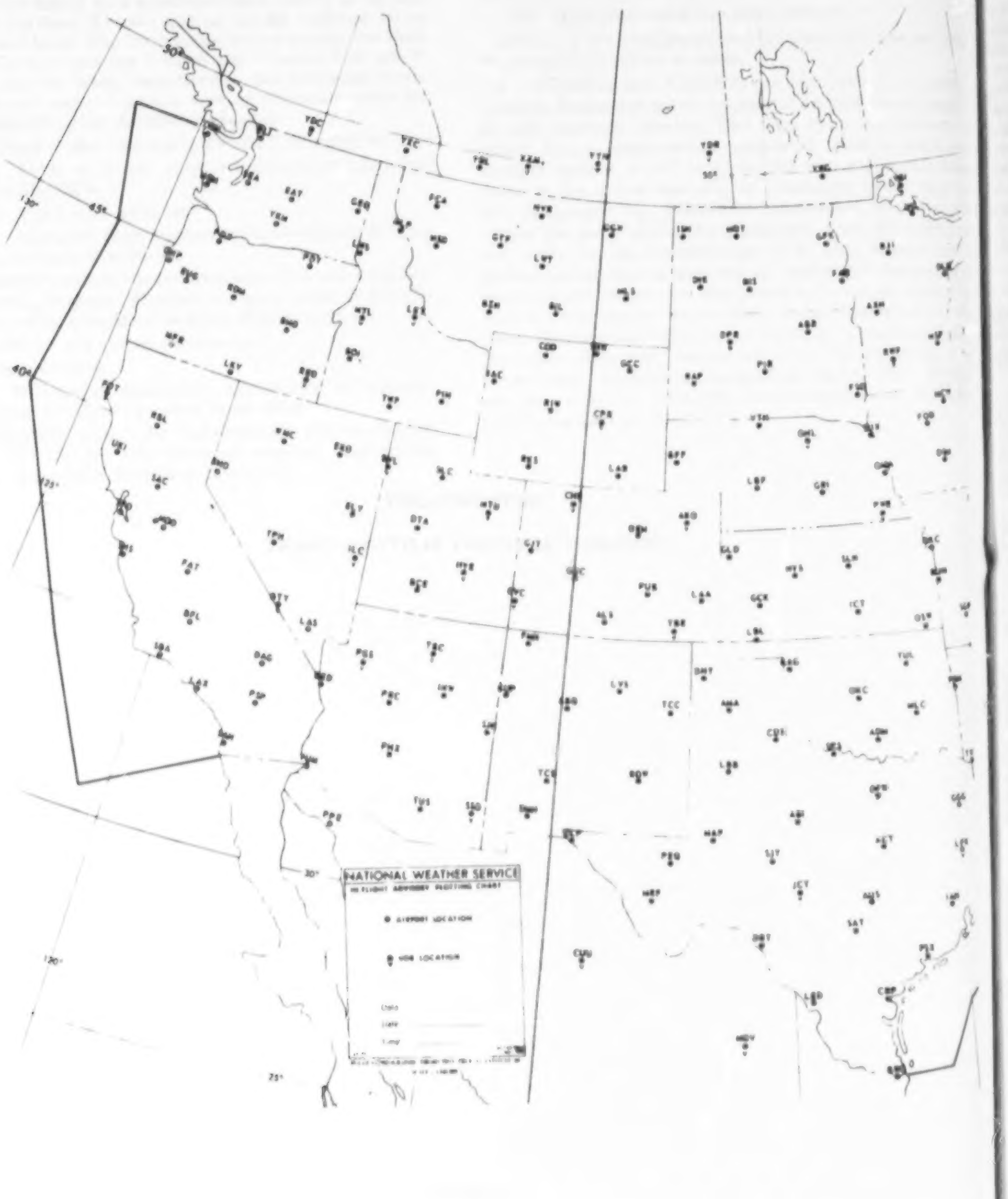
(5) Extensive mountain obscurement.

NOTE— If the above phenomena are adequately forecast in the FA, an AIRMET will not be issued.

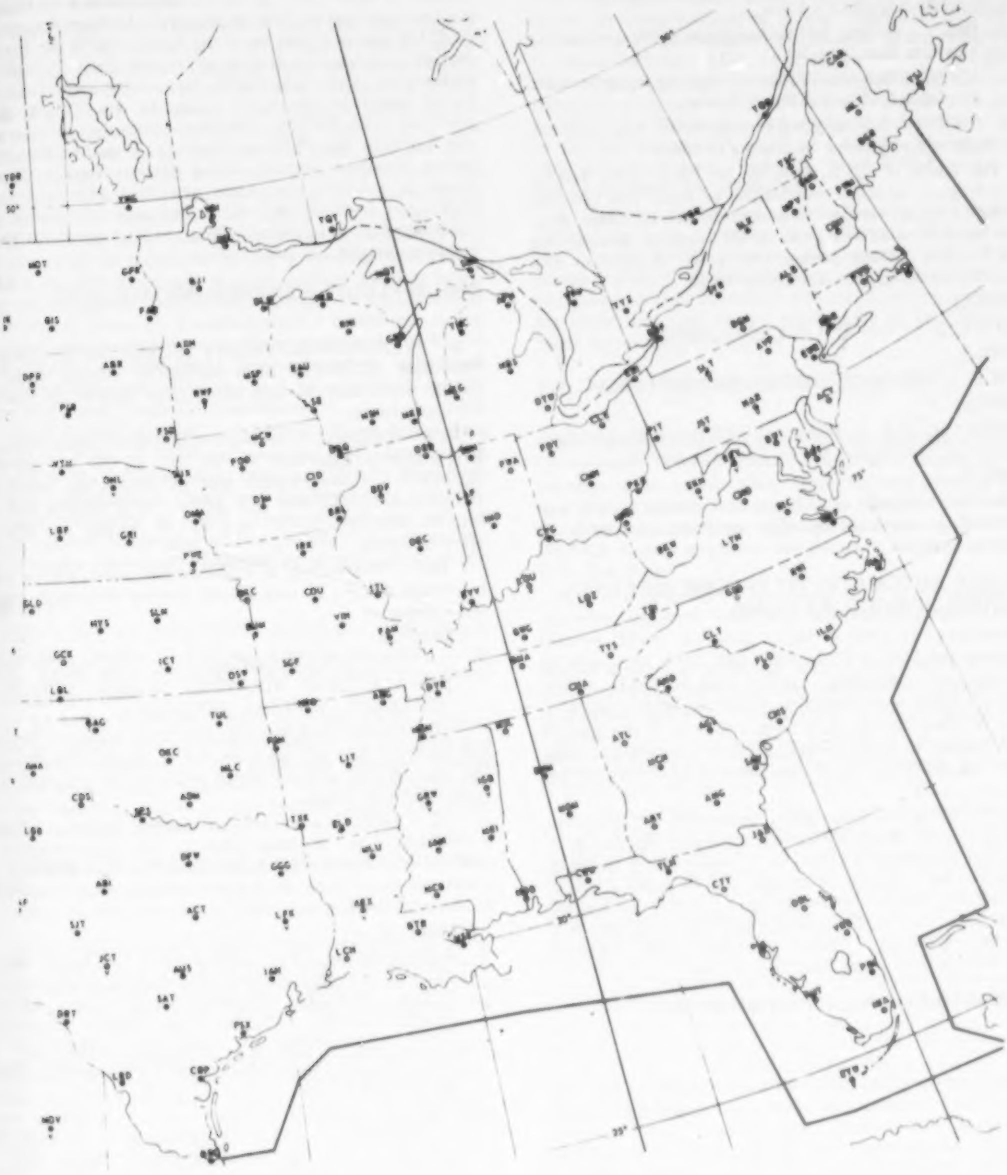
f. SIGMETs and AIRMETs are identified by an alphanumeric designator which consists of an alphabetic identifier and issuance number. The first time an advisory is issued for a phenomenon associated with a particular weather system, it will be given the next alphabetic designator in the series, and will be numbered as the first for that designator, e.g., BRAVO 1. Subsequent advisories will retain the same alphabetic designator until the phenomenon ends. In the conterminous U.S., this means that a phenonmenon that is assigned an alphabetic designator in one area will retain that designator as it moves within the area or into one or more other areas. Issuances for the same phenomenon will be sequentially numbered, using the same alphabetic designator until the phenomena no longer exist. Alphabetic designators ALFA—NOVEMBER are used only for SIGMETs, while designators OSCAR–ZULU are used for AIRMETs.

METEOROLOGY

IN-FLIGHT ADVISORY PLOTTING CHART


NATIONAL WEATHER SERVICE
IN-FLIGHT ADVISORY PLOTTING CHART
AIRPORT LOCATION
VOR LOCATION
Date
Time
50°
45°
40°
30°
25°
130°
125°
120°

IN-FLIGHT ADVISORY PLOTTING CHART


50°
30°
25°
75°
MOT
GFK
INL
DLH
ABR
MSP
EAU
RWF
DPR
PIR
FSD
MCW
LBF
GRI
GLD
HYS
SLN
ICT
GCK
LBL
GAG
TUL
OKC
MLC
ADM
CDS
LBB
DFW
GGG
ABI
ACT
AUS
SAT
SJT
JCT
DRT
LRD
CRP
BRO
PSX
IAH
LCH
LFK
AEX
BTR
MCB
JAN
MLU
ELD
TXK
LIT
FSM
SGF
COU
STL
DEC
BDF
BRL
DSM
CID
FOD
DBQ
MSN
LSE
SSM
TVC
MBS
DTW
FWA
CMH
IND
EVV
LOZ
PKB
EKN
TYS
GSO
RIC
SBY
JST
ALB
PWM
BGR
CAR
ATL
MCN
AGS
SAV
CHS
FLO
CLT
ILM
JAX
TLH
CTY
ORL
VRB
PBI
MIA
EYW

505. CATEGORICAL OUTLOOKS

a. Categorical outlook terms, describing general ceiling and visibility conditions for advanced planning purposes, are defined as follows:

(1) **LIFR (Low IFR)** — Ceiling less than 500 feet and/or visibility less than 1 mile.

(2) **IFR** — Ceiling 500 to less than 1,000 feet and/or visibility 1 to less than 3 miles.

(3) **MVFR (Marginal VFR)** — Ceiling 1,000 to 3,000 feet and/or visibility 3 to 5 miles inclusive.

(4) **VFR** — Ceiling greater than 3,000 feet and visibility greater than 5 miles; includes sky clear.

b. The cause of LIFR, IFR, or MVFR is indicated by either ceiling or visibility restrictions or both. The contraction "CIG" and/or weather and obstruction to vision symbols are used. If winds or gusts of 25 knots or greater are forecast for the outlook period, the word "WIND" is also included for all categories, including VFR.

EXAMPLE:

LIFR CIG — Low IFR due to low ceiling.

EXAMPLE:

IFR F — IFR due to visibility restricted by fog.

EXAMPLE:

MVFR CIG H K — Marginal VFR due both to ceiling and to visibility restricted by haze and smoke.

EXAMPLE:

IFR CIG R WIND — IFR due both to low ceiling and to visibility restricted by rain. wind expected to be 25 knots or greater.

506. PILOTS AUTOMATIC TELEPHONE WEATHER ANSWERING SERVICE (PATWAS)

a. PATWAS is a continuous recording of meteorological and aeronautical information which is available at selected locations by telephone. Normally the recording contains a summary of data for an area within 50NM of the parent station; however, at some locations route information similar to that available on the Transcribed Weather Broadcast (TWEB) is included.

b. PATWAS is not intended to substitute for specialist provided preflight briefings except for local flights. It is, however, recommended for use as a preliminary briefing, and often will be valuable in helping you to make a "go or no go" decision. Pilots are encouraged to avail themselves of this service. PATWAS locations are found in the Airport/Facility Directory under the FSS and National Weather Service Telephone Numbers section.

507. TRANSCRIBED WEATHER BROADCAST (TWEB)

a. Equipment is provided at selected FSSs by which meteorological and aeronautical data are recorded on tapes and broadcast continuously over selected low-frequency (190-535 kHz) navigational aids (L/MF range or H facility) and/or VORs. Broadcasts are made from a series of individual tape recordings, and changes, as they occur, are transcribed onto the tapes. The information provided varies depending on the type equipment available. Generally the broadcast contains route oriented data with specially prepared NWS forecasts, In-flight Advisories and winds aloft, plus preselected current information such as weather reports, NOTAMs and special notices. In some locations, the information is broadcast over the local VOR only and i limited to such items as the hourly weather for the parent station and up to 5 immediately adjacent stations, local NOTAM information, terminal forecast (FT) for the parent station, adverse conditions extracted from In-flight Advisories and other potentially hazardous conditions. At selected locations telephone access to the TWEB has been provided (TEL-TWEB). Telephone numbers for this service are found in the FSS and National Weather Service Telephone Numbers section of the Airport/Facility Directory These broadcasts are made available primarily for preflight and in-flight planning, and as such, should not be considered as a substitute for specialist provided preflight briefings except for local flights.

508. IN-FLIGHT WEATHER BROADCASTS

a. WEATHER ADVISORY BROADCASTS - FAA FSSs broadcast SIGMETs and AIRMETs during their valid period when they pertain to the area within 150 NM of the FSS as follows:

(1) SIGMETs - Convective SIGMETs upon receipt and at 15-minute intervals H+00, H+15, H+30 and H+4 SIGMETs - upon receipt and at 30-minute intervals a H+15 and H+45; and AIRMETs - upon receipt and at 3 minute intervals H+15 and H+45 during the first hou after issuance.

(2) Thereafter, a summarized alert notice will b broadcast at H+15 and H+45 during the valid period the advisories.

EXAMPLE:

A CONVECTIVE SIGMET IS CURRENT FOR SQUALL LINE RUNNING NORTH AND SOUT THROUGH CENTRAL NEBRASKA.

(3) Pilots, upon hearing the alert notice, if they hav not received the advisory or are in doubt, should conta the nearest FSS and ascertain whether the advisory is p tinent to their flights.

(4) ARTCCs and terminal control facilities broadca a SIGMET alert message once on all nonemergency f quencies within a 150 mile radius of the SIGMET g graphical area. These broadcasts contain a brief descripti of the weather activity and the general area affected.

EXAMPLE:

ATTENTION ALL AIRCRAFT, SIGMET DEL THREE. FROM MYTON TO TUBA CITY TO M FORD. SEVERE TURBULENCE AND SEVE CLEAR ICING BELOW ONE ZERO THOUSA FEET. REPORTED BY SEVERAL AIRCRAFT. PECTED TO CONTINUE BEYOND ZERO THR ZERO ZERO UTC.

EXAMPLE:

ATTENTION ALL AIRCRAFT, CONVECTI SIGMET TWO SEVEN EASTERN. FROM THE CINITY OF ELMIRA TO PHILLIPSBURG. SC TERED EMBEDDED THUNDERSTORMS MOVI EAST AT ONE ZERO KNOTS. A FEW INTEN

LEVEL FIVE CELLS, MAXIMUM TOPS FLIGHT LEVEL FOUR FIVE ZERO.

(5) ARTCC and terminal facilities broadcast a CENTER WEATHER ADVISORY (CWA) alert once on all frequencies, except emergency. The broadcast includes a general description of the area affected and a brief description of the type of weather.

b. HAZARDOUS IN-FLIGHT WEATHER ADVISORY SERVICE (HIWAS) - This is a continuous broadcast of inflight weather advisories including summarized SIGMETs, convective SIGMETs, AIRMETs and urgent PIREPs. HIWAS is presently broadcast over selected VORs in the Miami and Jacksonville ARTCC area. Following a test evaluation in those areas, HIWAS has been adopted as a national program and will be implemented throughout the conterminous U.S. as resources permit. In those areas where HIWAS is commissioned, ARTCC, Terminal ATC and FSS facilities have discontinued the broadcast of inflight advisories as described in the preceding paragraph. HIWAS is an additional source of hazardous weather information which makes these data available on a continuous basis. It is not, however, a replacement for preflight or inflight briefings or real-time weather updates from Flight Watch (EFAS). As HIWAS is implemented in individual center areas, the commissioning will be advertised in the Notices to Airmen (Class II) Publication.

c. UNSCHEDULED BROADCASTS - These broadcasts are made by FSSs on VOR and selected VHF frequencies upon receipt of special weather reports, PIREPs, NOTAMs and other information considered necessary to enhance safety and efficiency of flight. These broadcasts will be made at random times and will begin with the announcement "Aviation Broadcast" followed by identification of the data.

EXAMPLE:

AVIATION BROADCAST, SPECIAL WEATHER REPORT, (Notice to Airmen, Pilot Report, etc.) (location name twice) THREE SEVEN (past the hour) OBSERVATION...etc.

d. ALASKAN SCHEDULED BROADCASTS - Selected FSSs in Alaska having voice capability on radio ranges (VOR) or radio beacons (NDB) broadcast weather reports and Notice to Airmen information at 15 minutes past each hour from reporting points within approximately 150 miles from the broadcast station.

509. AUTOMATED WEATHER OBSERVING SYSTEM (AWOS)

a. Automated weather reporting systems are now being installed at several airports. These systems consist of various sensors, a processor, a voice synthesizer, and transmitter to relay local real-time weather data directly to the pilot.

b. Generically referred to as AWOS (Automated Weather Observing System), these real-time systems are operationally classified into three basic levels: AWOS-1, AWOS-2, and AWOS-3. AWOS-1 reports altimeter setting and wind data, and usually temperature, dewpoint, and density altitude. AWOS-2, when approved for operational use, will provide the information provided by AWOS-1, plus visibility. AWOS-3, when approved for operational use, will provide the information provided by AWOS-1, plus visibility and cloud/ceiling data.

c. The information is transmitted over a radio frequency or the voice portion of a local NAVAID. AWOS transmissions are receivable within 25 NM of the AWOS site, at or above 3000 feet AGL. In many cases, AWOS signals are receivable on the surface of the airport. Most devices automatically transmit a 20 to 30 second weather message once each minute. Pilots should monitor the designated frequency for the automated weather message. There is no two-way communication capability. Most AWOS weather data can be accessed via telephone.

d. Selected individual systems may be incorporated into nationwide data collection and dissemination networks in the future. AWOS information (system level, frequency, phone number, etc.) concerning specific locations, will be published as they become operational, in the Airport/Facility Directory, and where applicable, on published Instrument Approach Procedures.

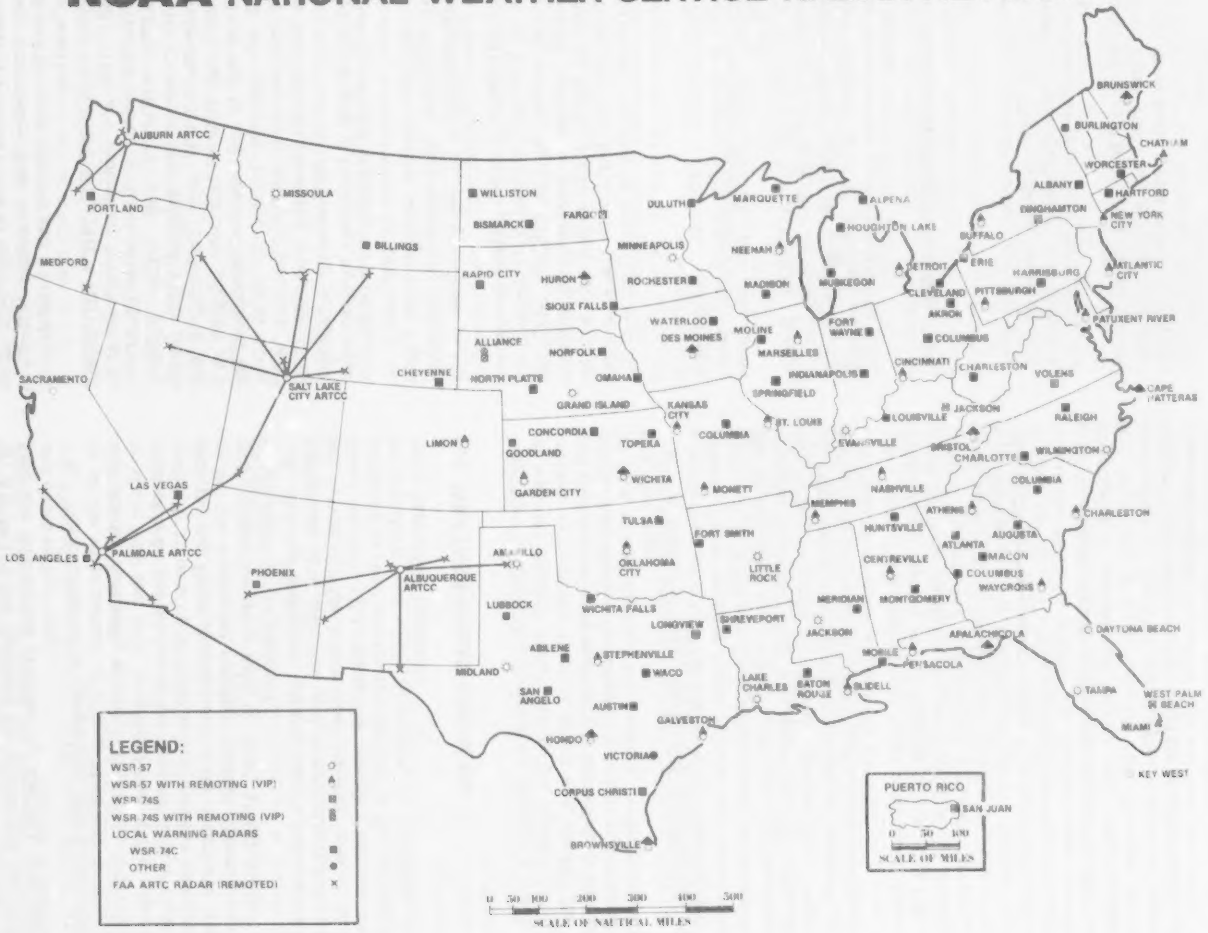
510. WEATHER RADAR SERVICES

a. The National Weather Service operates a network of 56 weather radars. These radars are spaced in such a manner as to enable them to detect and identify the type and characteristics of most of the precipitation east of the Continental Divide. In addition, 2 radars of the DOD and 22 FAA radars augment the network in the conterminous U.S. (See map.)

b. A scheduled radar observation is transmitted at 35 minutes past each hour, and more often under certain conditions. These weather radar reports are transmitted on service A to NWS and FAA stations and are available for use in preflight and in-flight planning. An hourly plain language radar summary is prepared at NWS radar offices and transmitted over the NOAA Weather Wire Circuit. In addition, hourly radar summary charts are prepared at the National Meteorological Center at Suitland, Maryland, for transmission on national facsimile circuits.

c. Some FSSs located near radar equipped national facilities have weather radar repeater scopes. The FSS specialist at these locations are certified to make interpretations of the weather displayed on the radar scope. They can brief a pilot on the displayed weather pattern as to the area covered and the weather movement. However, technical analysis of the characteristics of precipitation and cells is made by the NWS, who in turn forwards this information to the FSS pilot briefer. The weather radar presents a very dependable display of the weather within 125 miles, and storms of considerable heights and intensities can be seen at ranges of more than 125 NM. Through the combined efforts of the NWS and the FSS, a pilot can receive a comprehensive picture of the weather to assist him in planning a safe flight.

NOAA NATIONAL WEATHER SERVICE RADAR NETWORK


AUBURN ARTCC
PORTLAND
MEDFORD
SACRAMENTO
LOS ANGELES
PALMDALE ARTCC
LAS VEGAS
MISSOULA
BILLINGS
SALT LAKE CITY ARTCC
PHOENIX
ALBUQUERQUE ARTCC
CHEYENNE
LIMON
WILLISTON
BISMARCK
FARGO
RAPID CITY
HURON
SIOUX FALLS
ALLIANCE
NORFOLK
NORTH PLATTE
GRAND ISLAND
OMAHA
CONCORDIA
GOODLAND
TOPEKA
GARDEN CITY
WICHITA
AMARILLO
LUBBOCK
MIDLAND
ABILENE
SAN ANGELO
STEPHENVILLE
WACO
AUSTIN
HONDO
VICTORIA
CORPUS CHRISTI
BROWNSVILLE
GALVESTON
TULSA
OKLAHOMA CITY
WICHITA FALLS
LONGVIEW
SHREVEPORT
LAKE CHARLES
BATON ROUGE
SLIDELL
FORT SMITH
LITTLE ROCK
MONETT
KANSAS CITY
COLUMBIA
DULUTH
MINNEAPOLIS
ROCHESTER
WATERLOO
DES MOINES
MOLINE
MARSEILLES
SPRINGFIELD
ST. LOUIS
INDIANAPOLIS
EVANSVILLE
MARQUETTE
NEENAH
MADISON
ALPENA
HOUGHTON LAKE
MUSKEGON
DETROIT
FORT WAYNE
CLEVELAND
AKRON
COLUMBUS
CINCINNATI
LOUISVILLE
JACKSON
CHARLESTON
VOLENS
RALEIGH
BRISTOL
CHARLOTTE
WILMINGTON
COLUMBIA
NASHVILLE
MEMPHIS
HUNTSVILLE
ATHENS
ATLANTA
AUGUSTA
MACON
COLUMBUS
WAYCROSS
CENTREVILLE
MONTGOMERY
MERIDIAN
JACKSON
MOBILE
PENSACOLA
APALACHICOLA
CHARLESTON
DAYTONA BEACH
TAMPA
WEST PALM BEACH
MIAMI
KEY WEST
CAPE HATTERAS
PATUXENT RIVER
ATLANTIC CITY
HARRISBURG
PITTSBURGH
ERIE
BUFFALO
BINGHAMTON
ALBANY
NEW YORK CITY
HARTFORD
WORCESTER
CHATHAM
BURLINGTON
BRUNSWICK
LEGEND:
WSR-57 ○
WSR-57 WITH REMOTING (VIP) ▲
WSR-74S ■
WSR-74S WITH REMOTING (VIP) ▨
LOCAL WARNING RADARS
WSR-74C ■
OTHER ●
FAA ARTC RADAR (REMOTED) ×
0 50 100 200 300 400 500
SCALE OF NAUTICAL MILES
PUERTO RICO
SAN JUAN
0 50 100
SCALE OF MILES

511. ATC IN-FLIGHT WEATHER AVOIDANCE ASSISTANCE

a. ATC Radar Weather Display

(1) Areas of radar weather clutter result from rain or moisture. Radars cannot detect turbulence. The determination of the intensity of the weather displayed is based on its precipitation density. Generally, the turbulence associated with a very heavy rate of rainfall will normally be more severe than any associated with a very light rainfall rate.

(2) ARTCCs are phasing in computer generated digitized radar displays to replace broadband radar display. This new system, known as Narrowband Radar, provides the controller with two distinct levels of weather intensity by assigning radar display symbols for specific precipitation densities measured by the narrowband system.

b. Weather Avoidance Assistance

(1) To the extent possible, controllers will issue pertinent information on weather or chaff areas and assist pilots in avoiding such areas when requested. Pilots should respond to a weather advisory by either acknowledging the advisory or by acknowledging the advisory and requesting an alternative course of action as follows:

(a) Request to deviate off course by stating the number of miles and the direction of the requested deviation. In this case, when the requested deviation is approved, the pilot is expected to provide his own navigation, maintain the altitude assigned by ATC and to remain within the specified mileage of his original course.

(b) Request a new route to avoid the affected area.

(c) Request a change of altitude.

(d) Request radar vectors around the affected areas.

(2) For obvious reasons of safety, an IFR pilot must not deviate from the course or altitude or flight level without a proper ATC clearance. When weather conditions encountered are so severe that an immediate deviation is determined to be necessary and time will not permit approval by ATC, the pilot's emergency authority may be exercised.

(3) When the pilot requests clearance for a route deviation or for an ATC radar vector, the controller must evaluate the air traffic picture in the affected area, and coordinate with other controllers (if ATC jurisdictional boundaries may be crossed) before replying to the request.

(4) It should be remembered that the controller's primary function is to provide safe separation between aircraft. Any additional service, such as weather avoidance assistance, can only be provided to the extent that it does not derogate the primary function. It's also worth noting that the separation workload is generally greater than normal when weather disrupts the usual flow of traffic. ATC radar limitations and frequency congestion may also be a factor in limiting the controller's capability to provide additional service.

(5) It is very important, therefore, that the request for deviation or radar vector be forwarded to ATC as far in advance as possible. Delay in submitting it may delay or even preclude ATC approval or require that additional restrictions be placed on the clearance. Insofar as possible the following information should be furnished to ATC when requesting clearance to detour around weather activity:

(a) Proposed point where detour will commence.

(b) Proposed route and extent of detour (direction and distance).

(c) Point where original route will be resumed.

(d) Flight conditions (IFR or VFR).

(e) Any further deviation that may become necessary as the flight progresses.

(f) Advise if the aircraft is equipped with functioning airborne radar.

(6) To a large degree, the assistance that might be rendered by ATC will depend upon the weather information available to controllers. Due to the extremely transitory nature of severe weather situations, the controller's weather information may be of only limited value if based on weather observed on radar only. Frequent updates by pilots giving specific information as to the area affected, altitudes intensity and nature of the severe weather can be of considerable value. Such reports are relayed by radio or phone to other pilots and controllers and also receive widespread teletypewriter dissemination.

(7) Obtaining IFR clearance or an ATC radar vector to circumnavigate severe weather can often be accommodated more readily in the en route areas away from terminals because there is usually less congestion and, therefore, offer greater freedom of action. In terminal areas, the problem is more acute because of traffic density, ATC coordination requirements, complex departure and arrival routes, adjacent airports, etc. As a consequence, controllers are less likely to be able to accommodate all requests for weather detours in a terminal area or be in a position to volunteer such routing to the pilot. Nevertheless, pilots should not hesitate to advise controllers of any observed severe weather and should specifically advise controllers if they desire circumnavigation of observed weather.

512. RUNWAY VISUAL RANGE (RVR)

a. RVR visibility values are measured by transmissometers mounted on towers along the runway. A full RVR system consists of:

(1) Transmissometer projector and related items.

(2) Transmissometer receiver (detector) and related items.

(3) Analogue recorder.

(4) Signal data converter and related items.

(5) Remote digital or remote display programmer.

b. The transmissometer projector and receiver are mounted on towers either 250 or 500 feet apart. A known intensity of light is emitted from the projector and is measured by the receiver. Any obscuring matter such as rain, snow, dust, fog, haze or smoke reduces the light intensity arriving at the receiver. The resultant intensity measurement is then converted to an RVR value by the signal data converter. These values are displayed by readout equipment in the associated air traffic facility and updated approximately once every minute for controller issuance to pilots.

c. The signal data converter receives information on the high intensity runway edge light setting in use (step 3,

4, or 5); transmission values from the transmissometer, and the sensing of day or night conditions. From the three data sources, the system will compute appropriate RVR values. Due to variable conditions, the reported RVR values may deviate somewhat from the true observed visual range due to the slant range consideration, brief time delays between the observed RVR conditions and the time they are transmitted to the pilot, and rapidly changing visibility conditions.

d. An RVR transmissometer established on a 500 foot baseline provides digital readouts to a minimum of 1,000 feet. A system established on a 250 foot baseline provides digital readouts to a minimum of 600 feet, which are displayed in 200 foot increments to 3000 feet and in 500 foot increments from 3,000 feet to a maximum value of 6,000 feet.

e. RVR values for Category IIIa operations extend down to 700 feet RVR; however, only 600 and 800 feet are reportable RVR increments. The 800 RVR reportable value covers a range of 701 feet to 900 feet and is therefore a valid minimum indication of Category IIIa operations.

f. Approach categories with the corresponding minimum RVR values are as follows:

Category	*Visibility (RVR)*
Nonprecision	2400 feet
Category I	1800 feet
Category II	1200 feet
Category IIIa	700 feet
Category IIIb	150 feet
Category IIIc	0 feet

g. Ten minute maximum and minimum RVR values for the designated RVR runway are reported in the remarks section of the aviation weather report when the prevailing visibility is less than one mile and/or the RVR is 6,000 feet or less. ATCTs report RVR when the prevailing visibility is 1 mile or less and/or the RVR is 6,000 feet or less.

h. Details on the requirements for the operational use of RVR are contained in FAA ADVISORY CIRCULAR—97-1, "RUNWAY VISUAL RANGE." Pilots are responsible for compliance with minimums prescribed for their class of operations in appropriate FARs and/or operations specifications.

513. REPORTING OF CLOUD HEIGHTS

a. Ceiling, by definition in FARs, and as used in Aviation Weather Reports and Forecasts, is the height *above ground (or water) level* of the lowest layer of clouds or obscuring phenomenon that is reported as "broken", "overcast", or "obscuration" and not classified as "thin" or "partial". For example, a forecast which reads "CIGS WILL BE GENLY 1 TO 2 THSD FEET" refers to heights *above ground level* (AGL). A forecast which reads "BRKN TO OVC LYRS AT 8 TO 12 THSD MSL" states that the height is *above mean sea level* (MSL).

b. Pilots usually report height values above MSL, since they determine heights by the altimeter. This is taken in account when disseminating and otherwise applying information received from pilots. ("Ceilings" heights are always above ground level.) In reports disseminated as PIREPs, height references are given the same as received from pilots, that is, above MSL. In the following example of an hourly observation, a pilot report of the heights of the bases and tops of an overcast layer in the terminal area is converted by the reporting station to reflect AGL to report the base of the overcast layer (E12). The pilot's reported top of the overcast layer (23) is not converted to AGL and is shown in the remarks section (last item) of the weather reporting (top ovc 23)

EXAMPLE:

E12 OVC 2FK 132/49//47/0000/002/TOP OVC 23

c. In aviation forecasts (Terminal, Area, or In-flight Advisories) ceilings are denoted by the prefix "C" when used with sky cover symbols as in "LWRG to C5 OVC 1TRW", or by the contraction "CIG" before, or the contraction "AGL" after, the forecast cloud height value. When the cloud base is given in height above MSL, it is so indicated by the contraction "MSL" or "ASL" following the height value. The heights of clouds tops, freezing level, icing and turbulence are always given in heights above ASL or MSL.

514. REPORTING PREVAILING VISIBILITY

a. Surface (horizontal) visibility is reported in weather observations in terms of statute miles and increments thereof (e.g., 1/16, 1/8, 1/4, 1/2, 3/4, 1, 1 1/4, etc.). Visibility is determined through the ability to see and identify preselected and prominent objects at a known distance from the usual point of observation. Visibilities which are determined to be less than 7 miles identify the obscuring atmospheric condition, (e.g., fog, haze, smoke, etc., or combinations thereof).

b. Prevailing visibility is the greatest visibility equalled or exceeded throughout at least half of the horizon circle which need not be continuous. Segments of the horizon circle which may have a significantly lower visibility may be reported in the remarks section of the weather report (i.e., the southeastern quadrant of the horizon circle may be determined to be 2 miles in fog while the remaining quadrants are determined to be 3 miles in fog).

c. When the prevailing visibility at the usual point of observation, or at the tower level, is less than 4 miles, certificated tower personnel will take visibility observations in addition to those taken at the usual point of observation. The lower of these two values will be used as the prevailing visibility for aircraft operations.

515. ESTIMATING INTENSITY OF PRECIPITATION

a. **LIGHT —** Scattered drops or flakes that do not completely wet or cover an exposed surface, regardless of duration, to 0.10 inch per hour; maximum 0.01 inch in 6 minutes.

b. **MODERATE —** .11 inch to 0.30 inch per hour; more than 0.01 inch to 0.03 inch in 6 minutes.

c. **HEAVY —** More than 0.30 inch per hour; more than 0.03 inch in 6 minutes.

516. ESTIMATING INTENSITY OF DRIZZLE

a. **LIGHT —** Scattered drops that do not completely wet surface, regardless of duration, to 0.01 inch per hour.

b. **MODERATE —** More than 0.01 inch to 0.02 inch per hour.

c. **HEAVY —** More than 0.02 inch per hour.

517. ESTIMATING INTENSITY OF SNOW

a. **LIGHT —** Visibility 5/8 statute mile or more.

b. **MODERATE —** Visibility less than 5/8 statute mile but not less than 5/16 statute mile.

c. **HEAVY —** Visibility less than 5/16 statute mile.

518—519. RESERVED

520. PILOT WEATHER REPORTS (PIREP)

a. FAA air traffic facilities are required to solicit PIREPs when the following conditions are reported or forecast: Ceilings at or below 5,000 feet; Visibility at or below 5 miles; Thunderstorms and related phenomena; Icing of light degree or greater; Turbulence of moderate degree or greater; and Windshear.

b. Pilots are urged to cooperate and promptly volunteer reports of these conditions and other atmospheric data such as: Cloud bases, tops and layers; Flight visibility; Precipitation; Visibility restrictions such as haze, smoke and dust; Wind at altitude; and Temperature aloft.

c. PIREPs should be given to the ground facility with which communications are established, i.e., EFAS, FSS, ARTCC or terminal ATC. One of the primary duties of EFAS facilities, radio call "FLIGHT WATCH", is to serve as a collection point for the exchange of PIREPs with en route aircraft.

d. If pilots are not able to make PIREPs by radio, reporting upon landing of the in-flight conditions encountered to the nearest FSS or Weather Service Office will be helpful. Some of the uses made of the reports are:

(1) The ATCT uses the reports to expedite the flow of air traffic in the vicinity of the field and for hazardous weather avoidance procedures.

(2) The FSS uses the reports to brief other pilots, to provide in-flight advisories, and weather avoidance information to en route aircraft.

(3) The ARTCC uses the reports to expedite the flow of en route traffic, to determine most favorable altitudes, and to issue hazardous weather information within the center's area.

(4) The NWS uses the reports to verify or amend conditions contained in aviation forecast and advisories. In some cases, pilot reports of hazardous conditions are the triggering mechanism for the issuance of advisories. They also use the reports for pilot weather briefings.

(5) The NWS, other government organizations, the military, and private industry groups use PIREPs for research activities in the study of meteorological phenomena.

(6) All air traffic facilities and the NWS forward the reports received from pilots into the weather distribution system to assure the information is made available to all pilots and other interested parties.

e. The FAA, NWS, and other organizations that enter PIREPs into the weather reporting system use the format listed below. Items 1 through 6 are included in all transmitted PIREPs along with one or more of items 7 through 13. Although the PIREP should be as complete and concise as possible, pilots should not be overly concerned with strict format or phraseology. The important thing is that the information is relayed so other pilots may benefit from your observation. If a portion of the report needs clarification, the ground station will request the information.

PIREP ELEMENTS	PIREP CODE	CONTENTS
3-letter station identifier	XXX	Nearest weather reporting location to the reported phenomena
Report type	UA or UUA	Routine or Urgent PIREP
Location	/OV	In relation to a VOR
Time	/TM	Coordinated Universal Time
Altitude	/FL	Essential for turbulence and icing reports
Type Aircraft	/TP	Essential for turbulence and icing reports
Sky cover	/SK	Cloud height and coverage (scattered, broken, or overcast)
Weather	/WX	Flight visibility, precipitation, restrictions to visibility, etc.
Temperature	/TA	Degrees Celsius

—Continued

	PIREP ELEMENTS	PIREP CODE	CONTENTS
10.	Wind	/WV	Direction in degrees magnetic and speed in knots
11.	Turbulence	/TB	See paragraph 522
12.	Icing	/IC	See paragraph 521
13.	Remarks	/RM	For reporting elements not included or to clarify previously reported items

Completed PIREPs will be transmitted to weather circuits as in the following examples:

CMH UA /OV APE 230010/TM 1516/FL085/TP BE80/ SK BKN 065/WX FV03 H K/TA 20/TB LGT

Translation: One zero miles southwest of Appleton VOR; Time 1516 UTC; Altitude eight thousand five hundred; Aircraft type BE80; Top of the broken cloud layer is six thousand five hundred; Flight visibility 3 miles with haze and smoke; Air Temperature 20 degrees Celsius; Light turbulence.

CRW UV /OV BKW 360015-CRW/TM 1815/FL120//TP BE99/SK OVC/WX R/TA -08 /WV 290030/TB LGT-MDT/ IC LGT RIME/RM MDT MXD ICG DURGC ROA NWBND FL080-100 1750

Translation: From 15 miles north of Beckley VOR to Charleston VOR; Time 1815 UTC; Altitude 12,000 feet; Type aircraft, BE-99; In clouds; Rain; Temperature -08 Celsius; Wind 290 degrees magnetic at 30 knots; Light to moderate turbulence; Light Rime Icing; Encountered moderate mixed icing during climb northwestbound from Roanoke Va between 8000 and 10,000 feet at 1750 UTC.

521. PIREPS RELATING TO AIRFRAME ICING

a. The effects of ice on aircraft are cumulative — Thrust is reduced, Drag increases, Lift lessens, Weight increases. The results are an increase in stall speed and a deterioration of aircraft performance. In extreme cases, 2 to 3 inches of ice can form on the leading edge of the airfoil in less than 5 minutes. It takes but 1/2 inch of ice to reduce the lifting power of some aircraft by 50 percent and increases the frictional drag by an equal percentage.

b. A pilot can expect icing when flying in visible precipitation such as rain or cloud droplets, and the temperature is 0 degrees Celsius or colder. When icing is detected, a pilot should do one of two things (particularly if the aircraft is not equipped with deicing equipment), he should get out of the area of precipitation or go to an altitude where the temperature is above freezing. This "warmer" altitude may not always be a lower altitude. Proper preflight action includes obtaining information on the freezing level and the above-freezing levels in precipitation areas. Report icing to ATC/FSS, and if operating IFR, request new routing or altitude if icing will be a hazard. Be sure to give type of aircraft to ATC when reporting icing. The following describes how to report icing conditions.

(1) Trace — Ice becomes perceptible. Rate of accumulation is slightly greater than the rate of sublimation. It is not hazardous even though deicing/anti-icing equipment is not utilized, unless encountered for an extended period of time (over 1 hour).

(2) Light — The rate of accumulation may create a problem if flight is prolonged in this environment (over 1 hour). Occasional use of deicing/anti-icing equipment removes/prevents accumulation. It does not present a problem if the deicing/anti-icing equipment is used.

(3) Moderate — The rate of accumulation is such that even short encounters become potentially hazardous and use of deicing/anti-icing equipment or flight diversion is necessary.

(4) Severe — The rate of accumulation is such that deicing/anti-icing equipment fails to reduce or control the hazard. Immediate flight diversion is necessary.

EXAMPLE:

Pilot Report: Give Aircraft Identification, Location, Time (UTC), Intensity of Type, Altitude/FL, Aircraft Type, IAS, and Outside Air Temperature.

NOTE 1.—Rime Ice: Rough, milky, opaque ice formed by the instantaneous freezing of small supercooled water droplets.

NOTE 2.—Clear Ice: A glossy, clear, or translucent ice formed by the relatively slow freezing of large supercooled water droplets.

NOTE 3.—The Outside Air Temperature should be requested by the FSS/ATC if not included in the PIREP.

522. PIREPS RELATING TO TURBULENCE

a. When encountering turbulence, pilots are urgently requested to report such conditions to ATC as soon as practicable. PIREPs relating to turbulence should state:

(1) Aircraft location.

(2) Time of occurrence in UTC.

(3) Turbulence intensity.

(4) Whether the turbulence occurred in or near clouds.

(5) Aircraft altitude, or Flight Level.

(6) Type of Aircraft.

(7) Duration of turbulence.

EXAMPLE:

OVER OMAHA, 1232Z, MODERATE TURBULENCE IN CLOUDS AT FLIGHT LEVEL THREE ONE ZERO, BOEING 707.

EXAMPLE:

FROM FIVE ZERO MILES SOUTH OF ALBUQUERQUE TO THREE ZERO MILES NORTH OF PHOENIX, 1250Z, OCCASIONAL MODERATE CHOP AT FLIGHT LEVEL THREE THREE ZERO, DC8.

b. Duration and classification of intensity should be made using the following table:

TURBULENCE REPORTING CRITERIA TABLE

INTENSITY	AIRCRAFT REACTION	REACTION INSIDE AIRCRAFT	REPORTING TERM-DEFINITION
Light	Turbulence that momentarily causes slight, erratic changes in altitude and/or attitude (pitch, roll, yaw). Report as **Light Turbulence**;* or Turbulence that causes slight, rapid and somewhat rhythmic bumpiness without appreciable changes in altitude or attitude. Report as **Light Chop**.	Occupants may feel a slight strain against seat belts or shoulder straps. Unsecured objects may be displaced slightly. Food service may be conducted and little or no difficulty is encountered in walking.	Occasional – Less than 1/3 of the time. Intermittent – 1/3 to 2/3. Continuous – More than 2/3.
Moderate	Turbulence that is similar to Light Turbulence but of greater intensity. Changes in altitude and/or attitude occur but the aircraft remains in positive control at all times. It usually causes variations in indicated airspeed. Report as **Moderate Turbulence**;* or Turbulence that is similar to Light Chop but of greater intensity. It causes rapid bumps or jolts without appreciable changes in aircraft altitude or attitude. Report as **Moderate Chop**.	Occupants feel definite strains against seat belts or shoulder straps. Unsecured objects are dislodged. Food service and walking are difficult.	**NOTE** 1. Pilots should report location(s), time (UTC), intensity, whether in or near clouds, altitude, type of aircraft and, when applicable, duration of turbulence. 2. Duration may be based on time between two locations or over a single location. All locations should be readily identifiable. EXAMPLES: a. Over Omaha, 1232Z, Moderate Turbulence, in cloud, Flight Level 310, B707. b. From 50 miles south of Albuquerque to 30 miles north of Phoenix, 1210Z to 1250Z, occasional Moderate Chop, Flight Level 330, DC8.
Severe	Turbulence that causes large, abrupt changes in altitude and/or attitude. It usually causes large variations in indicated airspeed. Aircraft may be momentarily out of control. Report as **Severe Turbulence**. *	Occupants are forced violently against seat belts or shoulder straps. Unsecured objects are tossed about. Food service and walking are impossible.	
Extreme	Turbulence in which the aircraft is violently tossed about and is practically impossible to control. It may cause structural damage. Report as **Extreme Turbulence**.*		

* High level turbulence (normally above 15,000 feet ASL) not associated with cumuliform cloudiness, including thunderstorms, should be reported as CAT (clear air turbulence) preceded by the appropriate intensity, or light or moderate chop.

523. WIND SHEAR PIREPS

a. Because unexpected changes in wind speed and direction can be hazardous to aircraft operations at low altitudes on approach to and departing from airports, pilots are urged to promptly volunteer reports to controllers of wind shear conditions they encounter. An advance warning of this information will assist other pilots in avoiding or coping with a wind shear on approach or departure.

b. When describing conditions, use of the terms "negative" or "positive" wind shear should be avoided. PIREPs of "*negative* wind shear on final," intended to describe loss of airspeed and lift, have been interpreted to mean that *no* wind shear was encountered. The recommended method for wind shear reporting is to state the loss or gain of airspeed and the altitudes at which it was encountered.

EXAMPLE:

DENVER TOWER, CESSNA 1234 ENCOUNTERED WIND SHEAR, LOSS OF 20 KNOTS AT 400 FEET.

EXAMPLE:

TULSA TOWER, AMERICAN 721 ENCOUNTERED WIND SHEAR ON FINAL, GAINED 25 KNOTS BETWEEN 600 AND 400 FEET FOLLOWED BY LOSS OF 40 KNOTS BETWEEN 400 FEET AND SURFACE.

(1) Pilots who are not able to report wind shear in these specific terms are encouraged to make reports in terms of the effect upon their aircraft.

EXAMPLE:

MIAMI TOWER, GULFSTREAM 403 CHARLIE ENCOUNTERED AN ABRUPT WIND SHEAR AT 800 FEET ON FINAL, MAX THRUST REQUIRED.

(2) Pilots using Inertial Navigation Systems should report the wind and altitude both above and below the shear level.

524. CLEAR AIR TURBULENCE (CAT) PIREPS

CAT has become a very serious operational factor to flight operations at all levels and especially to jet traffic flying in excess of 15,000 feet. The best available information on this phenomena must come from pilots via the PIREP reporting procedures. All pilots encountering CAT conditions are urgently requested to report *time, location* and *intensity* (light, moderate, severe or extreme) of the element to the FAA facility with which they are maintaining radio contact. If time and conditions permit, elements should be reported according to the standards for other

PIREPs and position reports. (See PARA—522 - PIREPS RELATING TO TURBULENCE.)

525. THUNDERSTORMS

a. Turbulence, hail, rain, snow, lightning, sustained updrafts and downdrafts, icing conditions — all are present in thunderstorms. While there is some evidence that maximum turbulence exists at the middle level of a thunderstorm, recent studies show little variation of turbulence intensity with altitude.

b. There is no useful correlation between the external visual appearance of thunderstorms and the severity or amount of turbulence or hail within them. The visible thunderstorm cloud is only a portion of a turbulent system whose updrafts and downdrafts often extend far beyond the visible storm cloud. Severe turbulence can be expected up to 20 miles from severe thunderstorms. This distance decreases to about 10 miles in less severe storms.

c. Weather radar, airborne or ground based, will normally reflect the areas of moderate to heavy precipitation (radar does not detect turbulence). The frequency and severity of turbulence generally increases with the radar reflectivity which is closely associated with the areas of highest liquid water content of the storm. NO FLIGHT PATH THROUGH AN AREA OF STRONG OR VERY STRONG RADAR ECHOS SEPARATED BY 20-30 MILES OR LESS MAY BE CONSIDERED FREE OF SEVERE TURBULENCE.

d. Turbulence beneath a thunderstorm should not be minimized. This is especially true when the relative humidity is low in any layer between the surface and 15,000 feet. Then the lower altitudes may be characterized by strong out-flowing winds and severe turbulence.

e. The probability of lightning strikes occurring to aircraft is greatest when operating at altitudes where temperatures are between minus 5 degrees Celsius and plus 5 degrees Celsius. Lightning can strike aircraft flying in the clear in the vicinity of a thunderstorm.

f. The NWS recognizes only two classes of intensities of thunderstorms as applied to aviation surface weather observations:

(1) Thunderstorm T;

(2) Severe T+

g. NWS radar systems are able to objectively determine radar weather echo intensity levels by use of Video Integrator Processor (VIP) equipment. These thunderstorm intensity levels are on a scale of one to six. (See RADAR WEATHER ECHO INTENSITY LEVELS in the Pilot/Controller Glossary.)

EXAMPLE:

Alert provided by an ATC facility to an aircraft: (aircraft identification) LEVEL FIVE INTENSE WEATHER ECHO BETWEEN TEN O'CLOCK AND TWO O'CLOCK, ONE ZERO MILES MOVING EAST AT TWO ZERO KNOTS, TOP FLIGHT LEVEL THREE NINE ZERO.

EXAMPLE:

Alert provided by a FSS: (aircraft identification) LEVEL FIVE INTENSE WEATHER ECHO TWO ZERO MILES WEST OF ATLANTA VOR TWO FIVE MILES WIDE, MOVING EAST AT TWO ZERO KNOTS, TOPS FLIGHT LEVEL THREE NINE ZERO.

526. THUNDERSTORM FLYING

a. Above all, remember this: never regard any thunderstorm "lightly" even when radar observers report the echoes are of light intensity. Avoiding thunderstorms is the best policy. Following are some Do's and Don'ts of thunderstorm avoidance:

(1) Don't land or takeoff in the face of an approaching thunderstorm. A sudden gust front of low level turbulence could cause loss of control.

(2) Don't attempt to fly under a thunderstorm even if you can see through to the other side. Turbulence and wind shear under the storm could be disastrous.

(3) Don't fly without airborne radar into a cloud mass containing scattered embedded thunderstorms. Scattered thunderstorms not embedded usually can be visually circumnavigated.

(4) Don't trust the visual appearance to be a reliable indicator of the turbulence inside a thunderstorm.

(5) Do avoid by at least 20 miles any thunderstorm identified as severe or giving an intense radar echo. This is especially true under the anvil of a large cumulonimbus.

(6) Do clear the top of a known or suspected severe thunderstorm by at least 1,000 feet altitude for each 10 knots of wind speed at the cloud top. This should exceed the altitude capability of most aircraft.

(7) Do circumnavigate the entire area if the area has 6/10 thunderstorm coverage.

(8) Do remember that vivid and frequent lightning indicates the probability of a severe thunderstorm.

(9) Do regard as extremely hazardous any thunderstorm with tops 35,000 feet or higher whether the top is visually sighted or determined by radar.

b. If you cannot avoid penetrating a thunderstorm, following are some Do's *before* entering the storm:

(1) Tighten your safety belt, put on your shoulder harness if you have one and secure all loose objects.

(2) Plan and hold your course to take you through the storm in a minimum time.

(3) To avoid the most critical icing, establish a penetration altitude below the freezing level or above the level of minus 15 degrees Celsius.

(4) Verify that pitot heat is on and turn on carburetor heat or jet engine anti-ice. Icing can be rapid at any altitude and cause almost instantaneous power failure and/or loss of airspeed indication.

(5) Establish power settings for turbulence penetration airspeed recommended in your aircraft manual.

(6) Turn up cockpit lights to highest intensity to lessen temporary blindness from lightning.

(7) If using automatic pilot, disengage altitude hold mode and speed hold mode. The automatic altitude and speed controls will increase maneuvers of the aircraft thus increasing structural stress.

(8) If using airborne radar, tilt the antenna up and down occasionally. This will permit you to detect other hunderstorm activity at altitudes other than the one being lown.

c. Following are some Do's and Don'ts *during* the hunderstorm penetration:

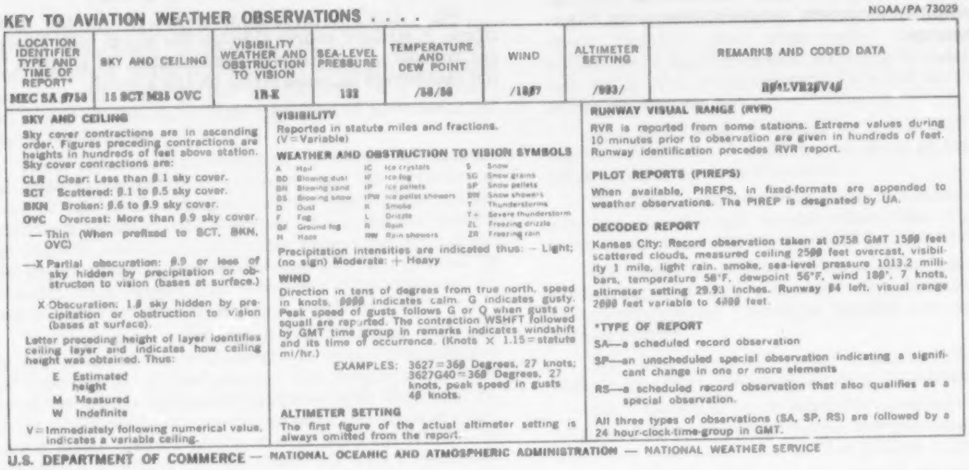
(1) Do keep your eyes on your instruments. Looking utside the cockpit can increase danger of temporary blind- ess from lightning.

(2) Don't change power settings; maintain settings for the recommended turbulence penetration airspeed.

(3) Do maintain constant attitude; let the aircraft "ride the waves." Manuevers in trying to maintain constant altitude increases stress on the aircraft.

(4) Don't turn back once you are in the thunderstorm. A straight course through the storm most likely will get you out of the hazards most quickly. In addition, turning maneuvers increase stress on the aircraft.

527. KEY TO AVIATION WEATHER OBSERVATIONS AND FORECASTS



KEY TO AVIATION WEATHER OBSERVATIONS . . . .

NOAA/PA 73029

LOCATION IDENTIFIER TYPE AND TIME OF REPORT*	SKY AND CEILING	VISIBILITY WEATHER AND OBSTRUCTION TO VISION	SEA-LEVEL PRESSURE	TEMPERATURE AND DEW POINT	WIND	ALTIMETER SETTING	REMARKS AND CODED DATA
MKC SA 0758	15 SCT M25 OVC	1R-K	132	/58/56	/1807	/993/	R04LVR20V40

SKY AND CEILING

Sky cover contractions are in ascending order. Figures preceding contractions are heights in hundreds of feet above station. Sky cover contractions are:

CLR Clear: Less than 0.1 sky cover.
SCT Scattered: 0.1 to 0.5 sky cover.
BKN Broken: 0.6 to 0.9 sky cover.
OVC Overcast: More than 0.9 sky cover.
— Thin (When prefixed to SCT, BKN, OVC)
—X Partial obscuration: 0.9 or less of sky hidden by precipitation or obstructon to vision (bases at surface.)
X Obscuration: 1.0 sky hidden by precipitation or obstruction to vision (bases at surface).

Letter preceding height of layer identifies ceiling layer and indicates how ceiling height was obtained. Thus:

E Estimated height
M Measured
W Indefinite

V = Immediately following numerical value, indicates a variable ceiling.

VISIBILITY

Reported in statute miles and fractions. (V = Variable)

WEATHER AND OBSTRUCTION TO VISION SYMBOLS

A	Hail	IC	Ice crystals	S	Snow
BD	Blowing dust	IF	Ice fog	SG	Snow grains
BN	Blowing sand	IP	Ice pellets	SP	Snow pellets
BS	Blowing snow	IPW	Ice pellet showers	SW	Snow showers
D	Dust	K	Smoke	T	Thunderstorms
F	Fog	L	Drizzle	T+	Severe thunderstorm
GF	Ground fog	R	Rain	ZL	Freezing drizzle
H	Haze	RW	Rain showers	ZR	Freezing rain

Precipitation intensities are indicated thus: – Light; (no sign) Moderate; + Heavy

WIND

Direction in tens of degrees from true north, speed in knots. 0000 indicates calm. G indicates gusty. Peak speed of gusts follows G or Q when gusts or squall are reported. The contraction WSHFT followed by GMT time group in remarks indicates windshift and its time of occurrence. (Knots × 1.15 = statute mi/hr.)

EXAMPLES: 3627 = 360 Degrees, 27 knots;
3627G40 = 360 Degrees, 27 knots, peak speed in gusts 40 knots.

ALTIMETER SETTING

The first figure of the actual altimeter setting is always omitted from the report.

RUNWAY VISUAL RANGE (RVR)

RVR is reported from some stations. Extreme values during 10 minutes prior to observation are given in hundreds of feet. Runway identification precedes RVR report.

PILOT REPORTS (PIREPS)

When available, PIREPS, in fixed-formats are appended to weather observations. The PIREP is desgnated by UA.

DECODED REPORT

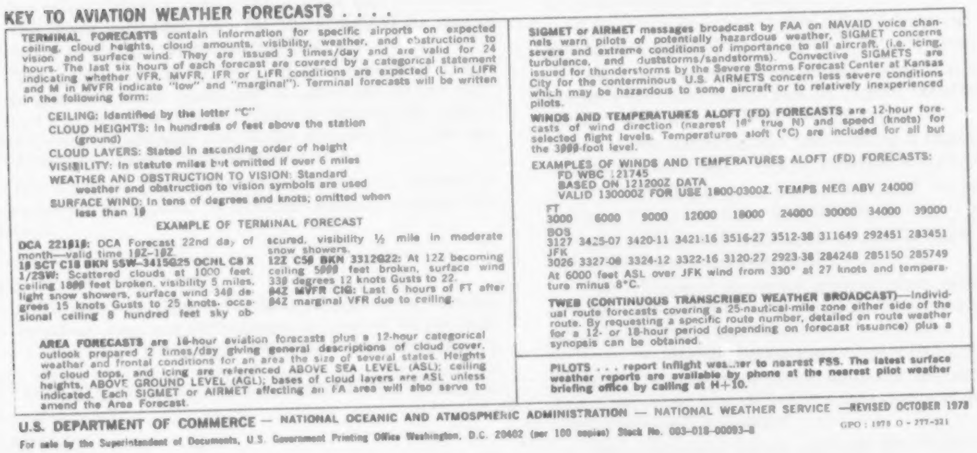
Kansas City: Record observation taken at 0758 GMT 1500 feet scattered clouds, measured ceiling 2500 feet overcast, visibility 1 mile, light rain, smoke, sea-level pressure 1013.2 millibars, temperature 58°F, dewpoint 56°F, wind 180°, 7 knots, altimeter setting 29.93 inches. Runway 04 left, visual range 2000 feet variable to 4000 feet.

***TYPE OF REPORT**

SA—a scheduled record observation
SP—an unscheduled special observation indicating a significant change in one or more elements
RS—a scheduled record observation that also qualifies as a special observation.

All three types of observations (SA, SP, RS) are followed by a 24 hour-clock-time-group in GMT.

U.S. DEPARTMENT OF COMMERCE — NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION — NATIONAL WEATHER SERVICE



KEY TO AVIATION WEATHER FORECASTS . . . .

TERMINAL FORECASTS contain information for specific airports on expected ceiling, cloud heights, cloud amounts, visibility, weather, and obstructions to vision and surface wind. They are issued 3 times/day and are valid for 24 hours. The last six hours of each forecast are covered by a categorical statement indicating whether VFR, MVFR, IFR or LIFR conditions are expected (L in LIFR and M in MVFR indicate "low" and "marginal"). Terminal forecasts will be written in the following form:

CEILING: Identified by the letter "C"
CLOUD HEIGHTS: In hundreds of feet above the station (ground)
CLOUD LAYERS: Stated in ascending order of height
VISIBILITY: In statute miles but omitted if over 6 miles
WEATHER AND OBSTRUCTION TO VISION: Standard weather and obstruction to vision symbols are used
SURFACE WIND: In tens of degrees and knots; omitted when less than 10

EXAMPLE OF TERMINAL FORECAST

DCA 221010: DCA Forecast 22nd day of month—valid time 10Z–10Z.

10 SCT C18 BKN 5SW–3415G25 OCNL C8 X 1/2SW: Scattered clouds at 1000 feet, ceiling 1800 feet broken, visibility 5 miles, light snow showers, surface wind 340 degrees 15 knots Gusts to 25 knots, occasional ceiling 8 hundred feet sky obscured, visibility ½ mile in moderate snow showers.

12Z C50 BKN 3312G22: At 12Z becoming ceiling 5000 feet broken, surface wind 330 degrees 12 knots Gusts to 22.

04Z MVFR CIG: Last 6 hours of FT after 04Z marginal VFR due to ceiling.

AREA FORECASTS are 18-hour aviation forecasts plus a 12-hour categorical outlook prepared 2 times/day giving general descriptions of cloud cover, weather and frontal conditions for an area the size of several states. Heights of cloud tops, and icing are referenced ABOVE SEA LEVEL (ASL); ceiling heights, ABOVE GROUND LEVEL (AGL); bases of cloud layers are ASL unless indicated. Each SIGMET or AIRMET affecting an FA area will also serve to amend the Area Forecast.

SIGMET or AIRMET messages broadcast by FAA on NAVAID voice channels warn pilots of potentially hazardous weather. SIGMET concerns severe and extreme conditions of importance to all aircraft. (i.e. icing, turbulence, and duststorms/sandstorms). Convective SIGMETS are issued for thunderstorms by the Severe Storms Forecast Center at Kansas City for the conterminous U.S. AIRMETS concern less severe conditions which may be hazardous to some aircraft or to relatively inexperienced pilots.

WINDS AND TEMPERATURES ALOFT (FD) FORECASTS are 12-hour forecasts of wind direction (nearest 10° true N) and speed (knots) for selected flight levels. Temperatures aloft (°C) are included for all but the 3000-foot level.

EXAMPLES OF WINDS AND TEMPERATURES ALOFT (FD) FORECASTS:

FD WBC 121745
BASED ON 121200Z DATA
VALID 130000Z FOR USE 1800-0300Z. TEMPS NEG ABV 24000

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
BOS	3127	3425-07	3420-11	3421-16	3516-27	3512-38	311649	292451	283451
JFK	3026	3327-08	3324-12	3322-16	3120-27	2923-38	284248	285150	285749

At 6000 feet ASL over JFK wind from 330° at 27 knots and temperature minus 8°C.

TWEB (CONTINUOUS TRANSCRIBED WEATHER BROADCAST)—Individual route forecasts covering a 25-nautical-mile zone either side of the route. By requesting a specific route number, detailed en route weather for a 12- or 18-hour period (depending on forecast issuance) plus a synopsis can be obtained.

PILOTS . . . report inflight weather to nearest FSS. The latest surface weather reports are available by phone at the nearest pilot weather briefing office by calling at H+10.

U.S. DEPARTMENT OF COMMERCE — NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION — NATIONAL WEATHER SERVICE —REVISED OCTOBER 1978

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528. AUTOB DECODING KEY

DECODING OBSERVATIONS FROM AUTOB STATIONS

EXAMPLE: **ENV AUTOB E25 BKN BV7 P 33/29/3606/975 PK WND 08 001**

ENCODE	DECODE	EXPLANATION
ENV	STATION IDENTIFICATION:	(Wendover, UT) Identifies report using FAA identifiers.
AUTOB	AUTOMATIC STATION IDENTIFIER	
E25 BKN	SKY & CEILING:	(Estimated 2500 ft. broken) Figures are height in 100s of feet above ground. Contraction after height is amount of sky cover. Letter preceding height indicates ceiling. WX reported if visibility is less than 2 miles and no clouds are detected. *NO CLOUDS REPORTED ABOVE 6000 FEET.*
BV7	BACKSCATTER VISIBILITY AVERAGED IN PAST MINUTE:	Reported in whole miles from 1 to 7.
P	PRECIPITATION OCCURRENCE:	(P = precipitation in past 10 minutes).
33	TEMPERATURE:	(33 degrees F.) Minus sign indicates sub-zero temperatures.
/29	DEW POINT:	(29 degrees F.) Minus sign indicates sub-zero temperatures.
/3606	WIND:	(360 degrees true at 6 knots) Direction is first two digits and is reported in tens of degrees. To decode, add a zero to first two digits. The last digits are speed; e.g., 2524 = 250 degrees at 24 knots.
/975	ALTIMETER SETTING:	(29.75 inches) The tens digit and decimal are omitted from report. To decode, prefix a 2 to code if it begins with 8 or 9. Otherwise, prefix a 3; e.g., 982 = 29.82, 017 = 30.17.
PK WND 08	PEAK WIND SPEED:	(8 knots) Reported speed is highest detected since last hourly observation.
001	PRECIPITATION ACCUMULATION:	(0.01 inches) Amount of precipitation since last synoptic time (00, 06, 12, 1800 UTC).

NOTE: If no clouds are detected below 6,000 feet and the visibility is greater than 2 miles, the reported sky condition will be *CLR BLO 60*.

529. RESERVED

NOTES

Section 2. ALTIMETER SETTING PROCEDURES

530. GENERAL

a. The accuracy of aircraft altimeters is subject to the following factors:

(1) Nonstandard temperatures of the atmosphere.

(2) Aircraft static pressure systems (position error), and

(3) Instrument error.

b. Pilots should disregard the effect of nonstandard atmospheric temperatures except that low temperatures need to be considered for terrain clearance purposes.

NOTE.— Standard temperature at sea level is 15 degrees Celsius (59 degrees Fahrenheit). The temperature gradient from sea level is 2 degrees Celsius (3.6 degrees Fahrenheit) per 1,000 feet. Pilots should apply corrections for static pressure systems and/or instruments, if appreciable errors exist.

c. Experience gained through volume of operations has led to the adoption of a standard altimeter setting for flights operating in the higher altitudes. A standard setting eliminates altitude conflicts caused by altimeter settings derived from different geographical sources. In addition, it eliminates station barometer errors and some of the altimeter instrument errors.

531. PROCEDURES

a. The cruising altitude or flight level of aircraft shall be maintained by reference to an altimeter which shall be set, when operating:

(1) **Below 18,000 feet MSL —** to the current reported altimeter setting of a station along the route and within 100 NM of the aircraft, or if there is no station within this area, the current reported altimeter setting of an appropriate available station. When an aircraft is en route on an instrument flight plan, the ATC controller will furnish this information to the pilot at least once while the aircraft is in his area of jurisdiction. In the case of an aircraft not equipped with a radio, set to the elevation of the departure airport or use an appropriate altimeter setting available prior to departure.

(2) **At or above 18,000 feet MSL —** to 29.92 inches of mercury (standard setting). The lowest usable flight level is determined by the atmospheric pressure in the area of operation as shown in the following table:

Altimeter Setting (Current Reported)	Lowest usable flight level
29.92 or higher	180
29.91 to 29.42	185
29.41 to 28.92	190
28.91 to 28.42	195
28.41 to 27.92	200

(3) Where the minimum altitude, as prescribed in FAR—91.109 and FAR—91.119, is above 18,000 feet MSL, the lowest usable flight level shall be the flight level equivalent of the minimum altitude plus the number of feet specified in the following table:

Altimeter Setting	Correction Factor
29.92 or higher	none
29.91 to 29.42	500 Feet
29.41 to 28.92	1000 Feet
28.91 to 28.42	1500 Feet
28.41 to 27.92	2000 Feet
27.91 to 27.42	2500 Feet

EXAMPLE:

The minimum safe altitude of a route is 19,000 feet MSL and the altimeter setting is reported between 29.92 and 29.42 inches of mercury, the lowest usable flight level will be 195, which is the flight level equivalent of 19,500 feet MSL (minimum altitude plus 500 feet).

532. ALTIMETER ERRORS

a. Most pressure altimeters are subject to mechanical, elastic, temperature, and installation errors. (Detailed information regarding the use of pressure alitimeters is found in the Instrument Flying Handbook, Chapter IV.) Although manufacturing and installation specifications, as well as the periodic test and inspections required by regulations (Far 43, Appendix E), act to reduce these errors, any scale error may be observed in the following manner:

(1) Set the current reported altimeter setting on the altimeter setting scale.

(2) Altimeter should now read field elevation if you are located on the same reference level used to establish the altimeter setting.

(3) Note the variation between the known field elevation and the altimeter indication. If this variation is in the order of plus or minus 75 feet, the accuracy of the altimeter is questionable and the problem should be referred to an appropriately rated repair station for evaluation and possible correction.

b. Once in flight, it is very important to frequently obtain current altimeter settings en route. If you do not reset your altimeter when flying *from* an area of high pressure or high temperatures *into* an area of low pressures or low temperature, *your aircraft will be closer to the surface than the altimeter indicates.* An inch error on the altimeter equals 1,000 feet of altitude. To quote an old saying: **"GOING FROM A HIGH TO A LOW, LOOK OUT BELOW."**

c. A reverse situation, without resetting the altimeter when going from a low temperature or low pressure area into a high temperature or high pressure area, the aircraft will be higher than the altimeter indicates.

d. The possible results of the above situations is obvious, particularly if operating at the minimum altitude or when conducting an instrument approach. If the altimeter is in error, you may still be on instruments when reaching

the minimum altitude (as indicated on the altimeter), whereas you might have been in the clear and able to complete the approach if the altimeter setting was correct.

533—539. RESERVED

Section 3. WAKE TURBULENCE

540. GENERAL

a. Every airplane generates a wake while in flight. Initially, when pilots encountered this wake in flight, the disturbance was attributed to "prop wash." It is known, however, that this disturbance is caused by a pair of counter rotating vortices trailing from the wing tips. The vortices from large aircraft pose problems to encountering aircraft. For instance, the wake of these aircraft can impose rolling movements exceeding the roll control capability of some aircraft. Further, turbulence generated within the vortices can damage aircraft components and equipment if encountered at close range. The pilot must learn to envision the location of the vortex wake generated by large aircraft and adjust his flight path accordingly.

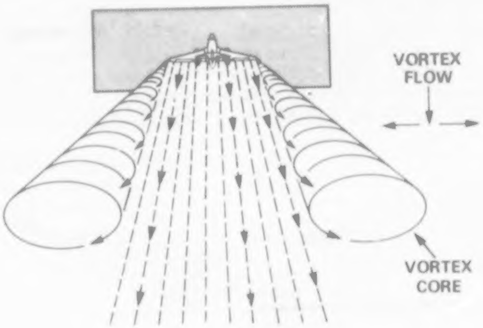
b. During ground operations, jet engine blast (thrust stream turbulence) can cause damage and upsets if encountered at close range. Exhaust velocity versus distance studies at various thrust levels have shown a need for light aircraft to maintain an adequate separation during ground operations. Below are examples of the distance requirements to avoid exhaust velocities of greater than 25 mph:

25 MPH VELOCITY	*B-727*	*DC-8*	*DC–10 / L–1011*	*B–747, B–767, B–757, A–300, and all re-engined B–707 / DC–8 aircraft*
Takeoff Thrust	550 Ft.	700 Ft.	2,100 Ft.	1,752 Ft.
Breakaway Thrust	200 Ft.	400Ft.	850 Ft.	1,250 Ft.
Idle Thrust	150 Ft.	100 Ft.	350 Ft.	620 Ft.

c. Engine exhaust velocities generated by large jet aircraft during initial takeoff roll and the drifting of the turbulence in relation to the crosswind component dictate the desirability of lighter aircraft awaiting takeoff to hold well back of the runway edge or taxiway hold line; also, the desirability of aligning the aircraft to face the possible jet engine blast movement. Additionally, in the course of running up engines and taxiing on the ground, pilots of large aircraft in particular should consider the effects of their jet blasts on other aircraft.

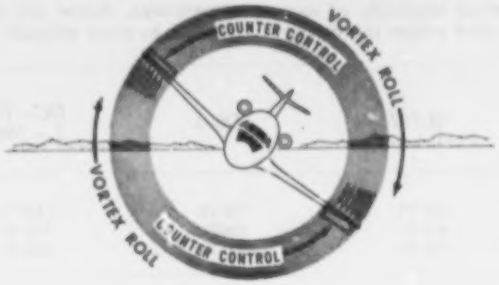
541. VORTEX GENERATION

Lift is generated by the creation of a pressure differential over the wing surface. The lowest pressure occurs over the upper wing surface and the highest pressure under the wing. This pressure differential triggers the roll up of the airflow aft of the wing resulting in swirling air masses trailing downstream of the wing tips. After the roll up is completed, the wake consists of two counter rotating cylindrical vortices.



542. VORTEX STRENGTH

a. The strength of the VORTEX is governed by the weight, speed, and shape of the wing of the generating aircraft. The VORTEX characteristics of any given aircraft can also be changed by extension of flaps or other wing configuring devices as well as by change in speed. However, as the basic factor is weight, the VORTEX strength increases proportionately. During tests, peak VORTEX tangential velocities were recorded at 224 feet per second, or about 133 knots. The greatest VORTEX strength occurs when the generating aircraft is HEAVY, CLEAN, and SLOW.



b. INDUCED ROLL

(1) In rare instances a wake encounter could cause in-flight structural damage of catastrophic proportions. However, the usual hazard is associated with induced rolling movements which can exceed the rolling capability of the encountering aircraft. In flight experiments, aircraft have been intentionally flown directly up trailing VORTEX cores of large aircraft. It was shown that the capability of an aircraft to counteract the roll imposed by the wake VORTEX primarily depends on the wing span and counter responsiveness of the encountering aircraft.

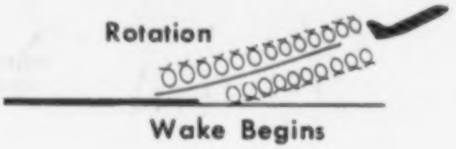
(2) Counter control is usually effective and induced roll minimal in cases where the wing span and ailerons of the encountering aircraft extend beyond the rotational flow field of the VORTEX. It is more difficult for aircraft with short wing span (relative to the generating aircraft) to counter the imposed roll induced by VORTEX flow. Pilots of short span aircraft, even of the high performance type, must be especially alert to VORTEX encounters.

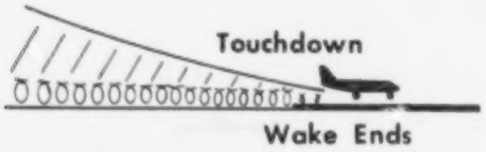
(3) The wake of large aircraft requires the respect of all pilots.

543. VORTEX BEHAVIOR

a. Trailing vortices have certain behavioral characteristics which can help a pilot visualize the wake location and thereby take avoidance precautions.

(1) Vortices are generated from the moment aircraft leave the ground, since trailing vortices are a by-product of wing lift. Prior to takeoff or touchdown pilots should note the rotation or touchdown point of the preceding aircraft.





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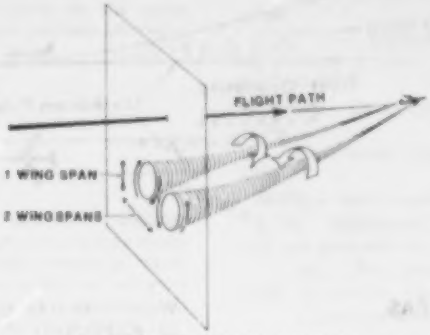
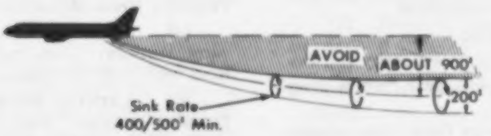
(2) The VORTEX circulation is outward, upward and around the wing tips when viewed from either ahead or behind the aircraft. Tests with large aircraft have shown that the VORTEX flow field, in a plane cutting through the wake at any point downstream, covers an area about 2 wing spans in width and one wing span in depth. The vortices remain so spaced (about a wing span apart) even drifting with the wind, at altitudes greater than a wing span from the ground. In view of this, if persistent VORTEX turbulence is encountered, a slight change of altitude and lateral position (preferably upwind) will provide a flight path clear of the turbulence.

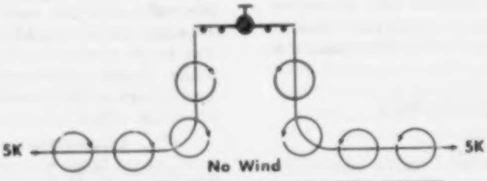


Vortex Flow Field in Aircraft Wake

(3) Flight tests have shown that the vortices from large aircraft sink at a rate of about 400 to 500 feet per minute. They tend to level off at a distance about 900 feet below the flight path of the generating aircraft. Vortex strength diminishes with time and distance behind the generating aircraft. Atmospheric turbulence hastens breakup. Pilots should fly at or above the large aircraft's flight path, altering course as necessary to avoid the area behind and below the generating aircraft.

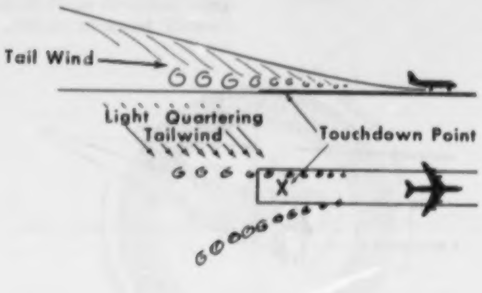


(4) When the vortices of large aircraft sink close to the ground (within about 200 feet), they tend to move laterally over the ground at a speed of about 5 knots.



Vortex Movement in Ground Effect - No Wind

b. A crosswind will decrease the lateral movement of the upwind VORTEX and increase the movement of the downwind VORTEX. Thus a light wind of 3 to 7 knots could result in the upwind VORTEX remaining in the touchdown zone for a period of time and hasten the drift of the downwind VORTEX toward another runway. Similarly, a tailwind condition can move the vortices of the preceding aircraft forward into the touchdown zone. THE LIGHT QUARTERING TAILWIND REQUIRES MAXIMUM CAUTION. Pilots should be alert to large aircraft upwind from their approach and takeoff flight paths.



544. OPERATIONS PROBLEM AREAS

a. A wake encounter is not necessarily hazardous. It can be one or more jolts with varying severity depending upon the direction of the encounter, distance from the generating aircraft, and point of VORTEX encounter. The probability of induced roll increases when the encountering aircraft's heading is generally aligned with the VORTEX trail or flight path of the generating aircraft.

b. AVOID THE AREA BELOW AND BEHIND THE GENERATING AIRCRAFT, ESPECIALLY AT LOW ALTITUDE WHERE EVEN A MOMENTARY WAKE ENCOUNTER COULD BE HAZARDOUS.

c. Pilots should be particularly alert in calm wind conditions and situations where the vortices could:

(1) Remain in the touchdown area.

(2) Drift from aircraft operating on a nearby runway.

(3) Sink into the takeoff or landing path from a crossing runway.

(4) Sink into the traffic patterns from other airport operations.

(5) Sink into the flight path of VFR flights operating at 500 feet AGL and below.

d. Pilots of all aircraft should visualize the location of the VORTEX trail behind large aircraft and use proper VORTEX avoidance procedures to achieve safe operation. It is equally important that pilots of large aircraft plan or adjust their flight paths to minimize VORTEX exposure to other aircraft.

545. VORTEX AVOIDANCE PROCEDURES

a. Under certain conditions, airport traffic controllers apply procedures for separating aircraft from heavy jet aircraft. The controllers will also provide VFR aircraft, with whom they are in communication and, which in the tower's opinion may be adversely affected by wake turbulence from a large aircraft, the position, altitude and direction of flight of the large aircraft followed by the phrase "CAUTION — WAKE TURBULENCE." WHETHER OR NOT A WARNING HAS BEEN GIVEN, HOWEVER, THE PILOT IS EXPECTED TO ADJUST HIS OPERATIONS AND FLIGHT PATH AS NECESSARY TO PRECLUDE SERIOUS WAKE ENCOUNTERS.

b. The following VORTEX avoidance procedures are recommended for the various situations:

(1) Landing behind a large aircraft — same runway: Stay at or above the large aircraft's final approach flight path — note his touchdown point — land beyond it.

(2) Landing behind a large aircraft — when parallel runway is closer than 2,500 feet: Consider possible drift to your runway. Stay at or above the large aircraft's final approach flight path — note his touchdown point.

(3) Landing behind a large aircraft — crossing runway: Cross above the large aircraft's flight path.

(4) Landing behind a departing large aircraft — same runway: Note the large aircraft's rotation point — land well prior to rotation point.

(5) Landing behind a departing large aircraft — crossing runway: Note the large aircraft's rotation point — if past the intersection — continue the approach — land prior to the intersection. If large aircraft rotates prior to the intersection, avoid flight below the large aircraft's flight path. Abandon the approach unless a landing is assured well before reaching the intersection.

(6) Departing behind a large aircraft: Note the large aircraft's rotation point — rotate prior to large aircraft's rotation point — continue climb above and stay upwind of the large aircraft's climb path until turning clear of his wake. Avoid subsequent headings which will cross below and behind a large aircraft. Be alert for any critical takeoff situation which could lead to a VORTEX encounter.

(7) Intersection takeoffs — same runway: Be alert to adjacent large aircraft operations particularly upwind of your runway. If intersection takeoff clearance is received, avoid subsequent heading which will cross below a large aircraft's path.

(8) Departing or landing after a large aircraft executing a low approach, missed approach or touch-and-go landing: Because vortices settle and move laterally near the ground, the VORTEX hazard may exist along the runway and in your flight path after a large aircraft has executed a low approach, missed approach or a touch-and-go landing, particular in light quartering wind conditions. You should assure that an interval of at least 2 minutes has elapsed before your takeoff or landing.

(9) En route VFR (thousand-foot altitude plus 500 feet): Avoid flight below and behind a large aircraft's path. If a large aircraft is observed above on the same track (meeting or overtaking) adjust your position laterally, preferably upwind.

546—549. RESERVED

550. HELICOPTERS

A hovering helicopter generates a downwash from its main rotor(s) similar to the prop blast of a conventional aircraft. However, in forward flight, this energy is transformed into a pair of trailing vortices similar to wing-tip vortices of fixed wing aircraft. Pilots of small aircraft should avoid the vortices as well as the downwash.

551. PILOT RESPONSIBILITY

a. Government and industry groups are making concerted efforts to minimize or eliminate the hazards of trailing vortices. However, the flight disciplines necessary to assure VORTEX avoidance during VFR operations must be exercised by the pilot. VORTEX visualization and avoidance procedures should be exercised by the pilot using the same degree of concern as in collision avoidance.

b. Wake turbulence may be encountered by aircraft in flight as well as when operating on the airport movement area. (See WAKE TURBULENCE in the Pilot/Controller Glossary.)

c. Pilots are reminded that in operations conducted behind all aircraft, acceptance of instructions from ATC in the following situations is an acknowledgment that the pilot will ensure safe takeoff and landing intervals and accepts the responsibility of providing his own wake turbulence separation.

(1) Traffic information,

(2) Instructions to follow an aircraft, and

(3) The acceptance of a visual approach clearance.

d. For operations conducted behind heavy aircraft, ATC will specify the word "heavy" when this information is known. Pilots of heavy aircraft should always use the word "heavy" in radio communications.

552. AIR TRAFFIC WAKE TURBULENCE SEPARATIONS

a. Because of the possible effects of wake turbulence, controllers are required to apply no less than specified minimum separation for aircraft operating behind a heavy jet and, in certain instances, behind large nonheavy aircraft.

(1) Separation is applied to aircraft operating directly behind a heavy jet at the same altitude or less than 1,000 feet below:

(a) Heavy jet behind heavy jet — 4 miles.

(b) Small/large aircraft behind heavy jet — 5 miles.

(2) Also, separation, measured at the time the preceding aircraft is over the landing threshold, is provided to small aircraft:

(a) Small aircraft landing behind heavy jet — 6 miles.

(b) Small aircraft landing behind large aircraft - 4 miles.

NOTE.— See Aircraft Classes in Pilot/Controller Glossary.

(3) Additionally, appropriate time or distance intervals are provided to departing aircraft:

(a) Two minutes or the appropriate 4 or 5 mile radar separation when takeoff behind a heavy jet will be:

- from the same threshold
- on a crossing runway and projected flight paths will cross
- from the threshold of a parallel runway when staggered ahead of that of the adjacent runway by less than 500 feet and when the runways are separated by less than 2,500 feet.

NOTE.— Pilots, after considering possible wake turbulence effects, may specifically request waiver of the 2-minute interval by stating, "request waiver of 2-minute interval" or a similar statement. Controllers may acknowledge this statement as pilot acceptance of responsibility for wake turbulence separation and, if traffic permits, issue takeoff clearance.

b. A 3-minute interval will be provided when a small aircraft will takeoff:

(1) From an intersection on the same runway (same or opposite direction) behind a departing large aircraft,

(2) In the opposite direction on the same runway behind a large aircraft takeoff or low/missed approach.

NOTE.— This 3-minute interval may be waived upon specific pilot request.

c. A 3-minute interval will be provided for all aircraft taking off when the operations are as described in b(1) and (2) above, the preceding aircraft is a heavy jet, and the operations are on either the same runway or parallel runways separated by less than 2,500 feet. Controllers may not reduce or waive this interval.

d. Pilots may request additional separation i.e., 2 minutes instead of 4 or 5 miles for wake turbulence avoidance. This request should be made as soon as practical on ground control and at least before taxiing onto the runway.

NOTE.— FAR 91.3(a) states: "The pilot in command of an aircraft is directly responsible for and is the final authority as to the operation of that aircraft."

553—559. RESERVED

NOTES

SECTION 4. BIRD HAZARDS, AND FLIGHT OVER NATIONAL REFUGES, PARKS, AND FORESTS

560. MIGRATORY BIRD ACTIVITY

a. Bird strike risk increases because of bird migration during the months of March through April, and August through November.

b. The altitudes of migrating birds vary with winds aloft, weather fronts, terrain elevations, cloud conditions, and other environmental variables. While over 90 percent of the reported bird strikes occur at or below 3,000 feet AGL, strikes at higher altitudes are common during migration. Ducks and geese are frequently observed up to 7,000 feet AGL and pilots are cautioned to minimize en route flying at lower altitudes during migration.

c. Considered the greatest potential hazard to aircraft because of their size, abundance, or habit of flying in dense flocks are gulls, waterfowl, vultures, hawks, owls, egrets, blackbirds, and starlings. Four major migratory flyways exist in the United States. The Atlantic flyway parallels the Atlantic Coast. The Mississippi Flyway stretches from Canada through the Great Lakes and follows the Mississippi River. The Central Flyway represents a broad area east of the Rockies, stretching from Canada through Central America. The Pacific Flyway follows the west coast and overflies major parts of Washington, Oregon, and California. There are also numerous smaller flyways which cross these major north-south migratory routes.

561. REDUCING BIRD STRIKE RISKS

a. The most serious strikes are those involving ingestion into an engine (turboprops and turbine jet engines) or windshield strikes. These strikes can result in emergency situations requiring prompt action by the pilot.

b. Engine ingestions may result in sudden loss of power or engine failure. Review engine out procedures, especially when operating from airports with known bird hazards or when operating near high bird concentrations.

c. Windshield strikes have resulted in pilots experiencing confusion, disorientation, loss of communications, and aircraft control problems. Pilots are encouraged to review their emergency procedures before flying in these areas.

d. When encountering birds en route, climb to avoid collision, because birds in flocks generally distribute themselves downward, with lead birds being at the highest altitude.

e. Avoid overflight of known areas of bird concentration and flying at low altitudes during bird migration. Charted wildlife refuges and other natural areas contain unusually high local concentration of birds which may create a hazard to aircraft.

562. REPORTING BIRD STRIKES

Pilots are urged to report strikes using FAA Form 5200-7, Bird Strike/Incident Report. This form is available at any FSS, General Aviation District Office, Air Carrier District Office, or at an FAA Regional Office. The data derived from these reports is used to develop standards to cope with this extensive hazard to aircraft and for documenation of necessary habitat control on airports.

563. REPORTING BIRD AND OTHER WILDLIFE ACTIVITIES

If you observe birds or other animals on or near the runway, request airport management to disperse the wildlife before taking off. Also contact the nearest FAA ARTCC, FSS, or tower (including non-Federal towers) regarding large flocks of birds and report the:

(1) Geographic location

(2) Bird type (geese, ducks, gulls, etc.)

(3) Approximate numbers

(4) Altitude

(5) Direction of bird flight path

564. PILOT ADVISORIES ON BIRD AND OTHER WILDLIFE HAZARDS

Many airports advise pilots of other wildlife hazards caused by large animals on the runway through the Airport/Facility Directory and the NOTAM system. Collisions of landing and departing aircraft and animals on the runway are increasing and are not limited to rural airports. These accidents have also occurred at several major airports. Pilots should exercise extreme caution when warned of the presence of wildlife on and in the vicinity of airports. If you observe deer or other large animals in close proximity to movement areas, advise the FSS, tower, or airport management.

565. FLIGHTS OVER CHARTED U.S. WILDLIFE REFUGES, PARKS, AND FOREST SERVICE AREAS

a. The landing of aircraft is prohibited on lands or waters administered by the National Park Service, U.S. Fish and Wildlife Service, or U.S. Forest Service without authorization from the respective agency. Exceptions, including

(1) when forced to land due to an emergency beyond the control of the operator,

(2) at officially designated landing sites, or

(3) an approved official business of the Federal Government.

b. All aircraft are requested to maintain a minimum altitude of 2,000 feet above the terrain of the following: National Parks, Monuments, Seashores, Lakeshores, Recreation Areas and Scenic Riverways administered by the National Park Service, National Wildlife Refuges, Big Game Refuges, Game Ranges and Wildlife Ranges administered by the U.S. Fish and Wildlife Service, and Wilderness and Primitive areas administered by the U.S. Forest Service.

c. Federal regulations also prohibit airdrops by parachute or other means of persons, cargo, or objects from aircraft on lands administered by the three agencies without authorization from the respective agency. Exceptions include:

(1) emergencies involving the safety of human life, or

(2) threat of serious property loss.

566-569. RESERVED.

Section 5. POTENTIAL FLIGHT HAZARDS

570. ACCIDENT CAUSE FACTORS

a. The 10 most frequent cause factors for General Aviation Accidents that involve the pilot in command are:

(1) Inadequate preflight preparation and/or planning.

(2) Failure to obtain and/or maintain flying speed.

(3) Failure to maintain direction control.

(4) Improper level off.

(5) Failure to see and avoid objects or obstructions.

(6) Mismanagement of fuel.

(7) Improper in-flight decisions or planning.

(8) Misjudgment of distance and speed.

(9) Selection of unsuitable terrain.

(10) Improper operation of flight controls.

b. This list remains relatively stable and points out the need for continued refresher training to establish a higher level of flight proficiency for all pilots. A part of the FAA's continuing effort to promote increased aviation safety is the General Aviation Accident Prevention Program. For information on Accident Prevention activities contact your nearest General Aviation or Flight Standards District Office.

c. ALERTNESS — Be alert at all times, especially when the weather is good. Most pilots pay attention to business when they are operating in full IFR weather conditions, but strangely, air collisions almost invariably have occurred under ideal weather conditions. Unlimited visibility appears to encourage a sense of security which is not at all justified. Considerable information of value may be obtained by listening to advisories being issued in the terminal area, even though controller workload may prevent a pilot from obtaining individual service.

d. GIVING WAY — If you think another aircraft is too close to you, give way instead of waiting for the other pilot to respect the right-of-way to which you may be entitled. It is a lot safer to pursue the right-of-way angle after you have completed your flight.

571. VFR IN CONGESTED AREAS

A high percentage of near midair collisions occur below 8,000 feet AGL and within 30 miles of an airport. When operating VFR in these highly congested areas, whether you intend to land at an airport within the area or are just flying through, it is recommended that extra vigilance be maintained and that you monitor an appropriate control frequency. Normally the appropriate frequency is an approach control frequency. By such monitoring action you can "get the picture" of the traffic in your area. When the approach controller has radar, radar traffic advisories may be given to VFR pilots upon request. (See PARA—162 - RADAR TRAFFIC INFORMATION SERVICE.)

572. OBSTRUCTIONS TO FLIGHT

a. Antenna Towers

Extreme caution should be exercised when flying less than 2,100 feet above ground level (AGL) because of the numerous skeletal structures (radio and television antenna towers) exceeding 1,000 feet AGL with some extending higher than 2,000 feet AGL. Most skeletal structures are supported by guy wires. The wires are difficult to see in good weather and can be totally obscured during periods of dusk and reduced visibility. These wires can extend about 1,500 feet horizontally from a structure; therefore, all skeletal structures should be avoided by at least 2,000 feet.

b. Overhead Wires

Overhead transmission and utility lines often span approaches to runways and scenic flyways such as lakes, rivers, and canyons. The supporting structures of these lines may not always be readily visible and the wires may be virtually invisible under certain conditions. Most of these installations do not meet criteria which determine them to be obstructions to air navigation and therefore do not require marking and/or lighting. The supporting structures of some overhead transmission lines are equipped with flashing strobe lights. These lights indicate wires exist between the strobed structures.

573. AVOID FLIGHT BENEATH UNMANNED BALLOONS

a. The majority of unmanned free balloons currently being operated have, extending below them, either a suspension device to which the payload or instrument package is attached, or a trailing wire antenna, or both. In many instances these balloon subsystems may be invisible to the pilot until his aircraft is close to the balloon, thereby creating a potentially dangerous situation. Therefore, good judgment on the part of the pilot dictates that aircraft should remain well clear of all unmanned free balloons and flight below them should be avoided at all times.

b. Pilots are urged to report any unmanned free balloons sighted to the nearest FAA ground facility with which communication is established. Such information will assist FAA ATC facilities to identify and flight follow unmanned free balloons operating in the airspace.

574. MOUNTAIN FLYING

a. Your first experience of flying over mountainous terrain (particularly if most of your flight time has been over the flatlands of the midwest) could be a never-to-be-forgotten nightmare if proper planning is not done and if you are not aware of the potential hazards awaiting. Those familiar section lines are not present in the mountains; those flat, level fields for forced landings are practically nonexistent; abrupt changes in wind direction and velocity occur; severe updrafts and downdrafts are common, particularly near or

above abrupt changes of terrain such as cliffs or rugged areas; even the clouds look different and can build up with startling rapidity. Mountain flying need not be hazardous if you follow the recommendations below:

b. File a flight plan. Plan your route to avoid topography which would prevent a safe forced landing. The route should be over populated areas and well known mountain passes. Sufficient altitude should be maintained to permit gliding to a safe landing in the event of engine failure.

c. Don't fly a light aircraft when the winds aloft, at your proposed altitude, exceed 35 miles per hour. Expect the winds to be of much greater velocity over mountain passes than reported a few miles from them. Approach mountain passes with as much altitude as possible. Downdrafts of from 1,500 to 2,000 feet per minute are not uncommon on the leeward side.

d. Don't fly near or above abrupt changes in terrain. Severe turbulence can be expected, especially in high wind conditions.

e. Some canyons run into a dead end. Don't fly so far up a canyon that you get trapped. ALWAYS BE ABLE TO MAKE A 180 DEGREE TURN!

f. Plan your trip for the early morning hours. As a rule, the air starts to get bad at about 10 a.m., and grows steadily worse until around 4 p.m., then gradually improves until dark. Mountain flying at night in a single engine light aircraft is asking for trouble.

g. When landing at a high altitude field, the same indicated airspeed should be used as at low elevation fields. *Remember:* that due to the less dense air at altitude, this same indicated airspeed actually results in higher true airspeed, a faster landing speed, and more important, a longer landing distance. During gusty wind conditions which often prevail at high altitude fields, a power approach and power landing is recommended. Additionally, due to the faster groundspeed, your takeoff distance will increase considerably over that required at low altitudes.

h. **Effects of Density Altitude.** Performance figures in the aircraft owner's handbook for length of takeoff run, horsepower, rate of climb, etc., are generally based on standard atmosphere conditions (59 degrees Fahrenheit (15 degrees Celsius), pressure 29.92 inches of mercury)at sea level. However, inexperienced pilots, as well as experienced pilots, may run into trouble when they encounter an altogether different set of conditions. This is particularly true in hot weather and at higher elevations. Aircraft operations at altitudes above sea level and at higher than standard temperatures are commonplace in mountainous areas. Such operations quite often result in a drastic reduction of aircraft performance capabilities because of the changing air density. Density altitude is a measure of air density. It is not to be confused with pressure altitude, true altitude or absolute altitude. It is not to be used as a height reference, but as a determining criteria in the performance capability of an aircraft. Air density decreases with altitude. As air density decreases, density altitude increases. The further effects of high temperature and high humidity are cumulative, resulting in an increasing high density altitude condition. High density altitude reduces all aircraft performance parameters. To the pilot, this means that the normal horsepower output is reduced, propeller efficiency is reduced and a higher true airspeed is required to sustain the aircraft throughout its operating parameters. It means an increase in runway length requirements for takeoff and landings, and decreased rate of climb. An average small airplane, for example, requiring 1,000 feet for takeoff at sea level under standard atmospheric conditions will require a takeoff run of approximately 2,000 feet at an operational altitude of 5,000 feet.

NOTE.— A turbo-charged aircraft engine provides some slight advantage in that it provides sea level horsepower up to a specified altitude above sea level.

(1) **Density Altitude Advisories** — at airports with elevations of 2,000 feet and higher, control towers and FSSs will broadcast the advisory "Check Density Altitude" when the temperature reaches a predetermined level. These advisories will be broadcast on appropriate tower frequencies or, where available, ATIS. FSSs will broadcast these advisories as a part of Airport Advisory Service, and on TWEB.

(2) These advisories are provided by air traffic facilities, as a reminder to pilots that high temperatures and high field elevations will cause significant changes in aircraft characteristics. The pilot retains the responsibility to compute density altitude, when appropriate, as a part of preflight duties.

NOTE.— All FSSs will compute the current density altitude upon request.

i. **Mountain Wave.** Many pilots go all their lives without understanding what a mountain wave is. Quite a few have lost their lives because of this lack of understanding. One need not be a licensed meteorologist to understand the mountain wave phenomenon.

(1) Mountain waves occur when air is being blown over a mountain range or even the ridge of a sharp bluff area. As the air hits the upwind side of the range, it starts to climb, thus creating what is generally a smooth updraft which turns into a turbulent downdraft as the air passes the crest of the ridge. From this point, for many miles downwind, there will be a series of downdrafts and updrafts. Satellite photos of the Rockies have shown mountain waves extending as far as 700 miles downwind of the range. Along the east coast area, such photos of the Appalachian chain have picked up the moutain wave phenomenon over a hundred miles eastward. All it takes to form a mountain wave is wind blowing across the range at 15 knots or better at an intersection angle of not less than 30 degrees.

(2) Pilots from flatland areas should understand a few things about mountain waves in order to stay out of trouble. When approaching a mountain range from the upwind side (generally the west), there will usually be a smooth updraft; therefore, it is not quite as dangerous an area as the lee of the range. From the leeward side, it is always a good idea to add an extra thousand feet or so of altitude because downdrafts can exceed the climb capability of the aircraft. Never expect an updraft when approaching a mountain chain from the leeward. Always be prepared to cope with a downdraft and turbulence.

(3) When approaching a mountain ridge from the downwind side, it is recommended that the ridge be approached at approximately a 45 degrees angle to the horizontal direction of the ridge. This permits a safer retreat from the ridge with less stress on the aircraft should severe turbulence and downdraft be experienced. If severe turbulence is encountered, simultaneously reduce power and adjust pitch until aircraft approaches maneuvering speed.

then adjust power and trim to maintain maneuvering speed and fly away from the turbulent area.

575—579. RESERVED

NOTES

Section 6. SAFETY, ACCIDENT AND HAZARD REPORTS

580. AVIATION SAFETY REPORTING PROGRAM

a. The FAA has established a voluntary Aviation Safety Reporting Program designed to stimulate the free and unrestricted flow of information concerning deficiencies and discrepancies in the aviation system. This is a positive program intended to ensure the safest possible system by identifying and correcting unsafe conditions before they lead to accidents. The primary objective of the program is to obtain information to evaluate and enhance the safety and efficiency of the present system.

b. This program applies primarily to that part of the system involving the safety of aircraft operations, including departure, en route, approach and landing operations and procedures, ATC procedures, pilot/controller communications, the aircraft movement area of the airport, and near midair collisions. Pilots, air traffic controllers, and all other members of the aviation community and the general public are asked to file written reports of any discrepancy or deficiency noted in these areas.

c. The report should give the date, time, location, persons and aircraft involved (if applicable), nature of the event, and all pertinent details.

d. To ensure receipt of this information, the program provides for the waiver of certain disciplinary actions against persons, including pilots and air traffic controllers, who file timely written reports concerning potentially unsafe incidents. To be considered timely, reports must be delivered or postmarked within 10 days of the incident unless that period is extended for good cause. Reporting forms are available at FAA facilities.

e. The FAA utilizes the National Aeronautics and Space Administration (NASA) to act as an independent third party to receive and analyze reports submitted under the program. This program is described in ADVISORY CIRCULAR—00-46.

581. AIRCRAFT ACCIDENT AND INCIDENT REPORTING

a. **OCCURRENCES REQUIRING NOTIFICATION —** The operator of an aircraft shall immediately, and by the most expeditious means available, notify the nearest National Transportation Safety Board (NTSB) Field Office when:

(1) An aircraft accident or any of the following listed incidents occur:

(a) Flight control system malfunction or failure;

(b) Inability of any required flight crew member to perform his normal flight duties as a result of injury or illness;

(c) Failure of structural components of a turbine engine excluding compressor and turbine blades and vanes.

(d) In-flight fire;

(e) Aircraft collide in flight.

(2) An aircraft is overdue and is believed to have been involved in an accident.

b. **MANNER OF NOTIFICATION:**

(1) The most expeditious method of [illegible] to the NTSB by the operator will be determi[illegible] circumstances existing at that time. The NT[illegible] that any of the following would be considere[illegible] examples of the type of notification that would be acceptable:

(a) Direct telephone notification.

(b) Telegraphic notification.

(c) Notification to the FAA who would in turn notify the NTSB by direct communication; i.e., dispatch or telephone.

c. **ITEMS TO BE NOTIFIED —** The notification required above shall contain the following information, if available:

(1) Type, nationality, and registration marks of the aircraft;

(2) Name of owner and operator of the aircraft;

(3) Name of the pilot-in-command;

(4) Date and time of the accident, or incident;

(5) Last point of departure and point of intended landing of the aircraft;

(6) Position of the aircraft with reference to some easily defined geographical point;

(7) Number of persons aboard, number killed, and number seriously injured;

(8) Nature of the accident, or incident, the weatheer, and the extent of damage to the aircraft, so far as is known; and

(9) A description of any explosives, radioactive materials, or other dangerous articles carried.

d. **FOLLOW UP REPORTS:**

(1) The operator shall file a report on NTSB Form 6120.1 or 6120.2, available from NTSB Field Offices, or from the NTSB, Washington, D.C., 20594.

(a) Within 10 days after an accident;

(b) When, after 7 days, an overdue aircraft is still missing;

(c) A report on an incident for which notification is required as described in subparagraph a(1) shall be filed only as requested by an authorized representative of the NTSB.

(2) Each crewmember, if physically able at the time the report is submitted, shall attach a statement setting forth the facts, conditions and circumstances relating to the accident or incident as they appear to him. If the crewmember is incapacitated, he shall submit the statement as soon as he is physically able.

e. **WHERE TO FILE THE REPORTS**

(1) The operator of an aircraft shall file with the NTSB Field Office nearest the accident or incident any report required by this section.

(2) The NTSB Field Offices are listed under U.S. Government in the telephone directories in the following cities: Anchorage, AK; Atlanta, GA; Chicago, IL; Denver, CO; Forth Worth, TX; Kansas City, MO; Los Angeles, CA; Miami, FL; New York, NY; Seattle, WA.

582. NEAR MIDAIR COLLISION REPORTING

a. PURPOSE AND DATA USES — The primary purpose of the Near Midair Collision (NMAC) Reporting Program is to provide information for use in enhancing the safety and efficiency of the National Airspace System. Data obtained from NMAC reports are used by the FAA to improve the quality of FAA services to users and to develop programs, policies, and procedures aimed at the reduction of NMAC occurrences. All NMAC reports are thoroughly investigated by Flight Standards Facilities in coordination with Air Traffic Facilities. Data from these investigations are transmitted to FAA Headquarters in Washington, D.C. where they are compiled and analyzed, and where safety programs and recommendations are developed.

b. DEFINITION — A near midair collision is defined as an incident associated with the operation of an aircraft in which a possibility of collision occurs as a result of proximity of less than 500 feet to another aircraft, or a report is received from a pilot or a flight crew member stating that a collision hazard existed between two or more aircraft.

c. REPORTING RESPONSIBILITY — It is the responsibility of the pilot and/or flight crew to determine whether a near midair collision did actually occur and, if so, to initiate a NMAC report. Be specific, as ATC will not interpret a casual remark to mean that a NMAC is being reported.

d. WHERE TO FILE REPORTS — Pilots and/or flight crew members involved in NMAC occurrences are urged to report each incident immediately:

(1) By radio or telephone to the nearest FAA ATC facility or FSS.

(2) In writing, in lieu of the above, to the nearest Air Carrier District Office (ACDO), General Aviation District Office (GADO), or Flight Standards District Office (FSDO).

e. ITEMS TO BE REPORTED —

(1) Date and Time (UTC) of incident.

(2) Location of incident and altitude.

(3) Identification and type of reporting aircraft, aircrew destination, name and home base of pilot.

(4) Identification and type of other aircraft, aircrew destination, name and home base of pilot.

(5) Type of flight plans; station altimeter setting used.

(6) Detailed weather conditions at altitude or flight level.

(7) Approximate courses of both aircraft: indicate if one or both aircraft were climbing or descending.

(8) Reported separation in distance at first sighting, proximity at closest point horizontally and vertically, length of time in sight prior to evasive action.

(9) Degree of evasive action taken, if any (from both aircraft, if possible).

(10) Injuries, if any.

f. INVESTIGATION — The district office responsible for the investigation and reporting of NMAC's will be:

(1) The Air Carrier or Flight Standards District Office in whose area the incident occurred when an air carrier aircraft is involved.

(2) The General Aviation or Flight Standards District Office in whose area the incident occurred in all other cases.

Existing radar, communication, and weather data will be examined in the conduct of the investigation. When possible, all cockpit crew members will be interviewed regarding factors involving the NMAC incident. Air Traffic controllers will be interviewed in cases where one or more of the involved aircraft was provided ATC service. Both flight and ATC procedures will be evaluated. When the investigation reveals a violation of an FAA regulation, enforcement action will be pursued.

583—599. RESERVED

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Chapter 7. MEDICAL FACTS FOR PILOTS

Section 1. FITNESS FOR FLIGHT

600. FITNESS FOR FLIGHT

a. Medical Certification

(1) All pilots except those flying gliders and free air balloons must possess valid medical certificates in order to exercise the privileges of their airman certificates. The periodic medical examinations required for medical certification are conducted by designated Aviation Medical Examiners, who are physicians with a special interest in aviation safety and training in aviation medicine.

(2) The standards for medical certification are contained in FAR—67. Pilots who have a history of certain medical conditions described in these standards are mandatorily disqualified from flying. These medical conditions include a personality disorder manifested by overt acts, a psychosis, alcoholism, drug dependence, epilepsy, an unexplained disturbance of consciousness, myocardial infarction, angina pectoris and diabetes requiring medication for its control. Other medical conditions may be temporarily disqualifying, such as acute infections, anemia, and peptic ulcer. Pilots who do not meet medical standards may still be qualified under special issuance provisions or the exemption process. This may require that either additional medical information be provided or practical flight tests be conducted.

(3) Student pilots should visit an Aviation Medical Examiner as soon as possible in their flight training in order to avoid unnecessary training expenses should they not meet the medical standards. For the same reason, the student pilot who plans to enter commercial aviation should apply for the highest class of medical certificate that might be necessary in the pilot's career.

> *Caution:* The FARs prohibit a pilot who possesses a current medical certificate from performing crewmember duties while the pilot has a known medical condition or increase of a known medical condition that would make the pilot unable to meet the standards for the medical certificate.

b. Illness

(1) Even a minor illness suffered in day-to-day living can seriously degrade performance of many piloting tasks vital to safe flight. Illness can produce fever and distracting symptoms that can impair judgment, memory, alertness, and the ability to make calculations. Although symptoms from an illness may be under adequate control with a medication, the medication itself may decrease pilot performance.

(2) The safest rule is not to fly while suffering from any illness. If this rule is considered too stringent for a particular illness, the pilot should contact an Aviation Medical Examiner for advice.

c. Medication

(1) Pilot performance can be seriously degraded by both prescribed and over-the-counter medications, as well as by the medical conditions for which they are taken. Many medications, such as tranquilizers, sedatives, strong pain relievers, and cough-suppressant preparations, have primary effects that may impair judgment, memory, alertness, coordination, vision, and the ability to make calculations. Others, such as antihistamines, blood pressure drugs, muscle relaxants, and agents to control diarrhea and motion sickness, have side effects that may impair the same critical functions. Any medication that depresses the nervous system, such as a sedative, tranquilizer or antihistamine, can make a pilot much more susceptible to hypoxia.

(2) The FARs prohibit pilots from performing crewmember duties while using any medication that affects the faculties in any way contrary to safety. The safest rule is not to fly as a crewmember while taking any medication, unless approved to do so by the FAA.

d. Alcohol

(1) Extensive research has provided a number of facts about the hazards of alcohol consumption and flying. As little as one ounce of liquor, one bottle of beer or four ounces of wine can impair flying skills, with the alcohol consumed in these drinks being detectable in the breath and blood for at least 3 hours. Even after the body completely destroys a moderate amount of alcohol, a pilot can still be severely impaired for many hours by hangover. There is simply no way of increasing the destruction of alcohol or alleviating a hangover. Alcohol also renders a pilot much more susceptible to disorientation and hypoxia.

(2) A consistently high alcohol related fatal aircraft accident rate serves to emphasize that alcohol and flying are a potentially lethal combination. The FARs prohibit pilots from performing crewmember duties within 8 hours after drinking any alcoholic beverage or while under the influence of alcohol. However, due to the slow destruction of alcohol, a pilot may still be under influence 8 hours after drinking a moderate amount of alcohol. Therefore, an excellent rule is to allow at least 12 to 24 hours between "bottle and throttle," depending on the amount of alcoholic beverage consumed.

e. Fatigue

(1) Fatigue continues to be one of the most treacherous hazards to flight safety, as it may not be apparent to a pilot until serious errors are made. Fatigue is best described as either acute (short-term) or chronic (long-term).

(2) A normal occurrence of everyday living, acute fatigue is the tiredness felt after long periods of physical and mental strain, including strenuous muscular effort, immobility, heavy mental workload, strong emotional pressure, monotony and lack of sleep. Consequently, coordination and alertness, so vital to safe pilot performance, can be reduced. Acute fatigue is prevented by adequate rest and sleep, as well as regular exercise and proper nutrition.

(3) Chronic fatigue occurs when there is not enough time for full recovery between episodes of acute fatigue. Performance continues to fall off, and judgment becomes impaired so that unwarranted risks may be taken. Recovery from chronic fatigue requires a prolonged period of rest.

f. Stress

(1) Stress from the pressures of everyday living can impair pilot performance, often in very subtle ways. Difficulties, particularly at work, can occupy thought processes enough to markedly decrease alertness. Distraction can so interfere with judgment that unwarranted risks are taken, such as flying into deteriorating weather conditions to keep on schedule. Stress and fatigue (see above) can be an extremely hazardous combination.

(2) Most pilots do not leave stress "on the ground." Therefore, when more than usual difficulties are being experienced, a pilot should consider delaying flight until these difficulties are satisfactorily resolved.

g. Emotion

(1) Certain emotionally upsetting events, including a serious argument, death of a family member, separation or divorce, loss of job and financial catastrophe, can render a pilot unable to fly an aircraft safely. The emotions of anger, depression, and anxiety from such events not only decrease alertness but also may lead to taking risks that border on self-destruction. Any pilot who experiences an emotionally upsetting event should not fly until satisfactorily recovered from it.

h. Personal Checklist

(1) Aircraft accident statistics show that pilots should be conducting preflight checklists on themselves as well as their aircraft, for pilot impairment contributes to many more accidents than failures of aircraft systems. A personal checklist that can be easily committed to memory, which includes all of the categories of pilot impairment as discussed in this section, is being distributed by the FAA in the form of a wallet-sized card.

PERSONAL CHECKLIST

I'm physically and mentally safe to fly — not being impaired by:

I llness,
M edication,
S tress,
A lcohol,
F atigue,
E motion.

601. EFFECTS OF ALTITUDE

a. Hypoxia

(1) Hypoxia is a state of oxygen deficiency in the body sufficient to impair functions of the brain and other organs. Hypoxia from exposure to altitude is due only to the reduced barometric pressures encountered at altitude, for the concentration of oxygen in the atmosphere remains about 21 percent from the ground out to space.

(2) Although a deterioration in night vision occurs at a cabin pressure altitude as low as 5,000 feet, other significant effects of altitude hypoxia usually do not occur in the normal healthy pilot below 12,000 feet. From 12,000 to 15,000 feet of altitude, judgment, memory, alertness, coordination and ability to make calculations are impaired, and headache, drowsiness, dizziness and either a sense of well-being (euphoria) or belligerence occur. The effects appear following increasingly shorter periods of exposure to increasing altitude. In fact, pilot performance can seriously deteriorate within 15 minutes at 15,000 feet.

(3) At cabin pressure altitudes above 15,000 feet, the periphery of the visual field grays out to a point where only central vision remains (tunnel vision). A blue coloration (cyanosis) of the fingernails and lips develops. The ability to take corrective and protective action is lost in 20 to 30 minutes at 18,000 feet and 5 to 12 minutes at 20,000 feet, followed soon thereafter by unconsciousness.

(4) The altitude at which significant effects of hypoxia occur can be lowered by a number of factors. Carbon monoxide inhaled in smoking or from exhaust fumes, lowered hemoglobin (anemia), and certain medications can reduce the oxygen-carrying capacity of the blood to the degree that the amount of oxygen provided to body tissues will already be equivalent to the oxygen provided to the tissues when exposed to a cabin pressure altitude of several thousand feet. Small amounts of alcohol and low doses of certain drugs, such as antihistamines, tranquilizers, sedatives and analgesics can, through their depressant action, render the brain much more susceptible to hypoxia. Extreme heat and cold fever, and anxiety increase the body's demand for oxygen, and hence its susceptibility to hypoxia.

(5) The effects of hypoxia are usually quite difficult to recognize, especially when they occur gradually. Since symptoms of hypoxia do not vary in an individual, the ability to recognize hypoxia can be greatly improved by experiencing and witnessing the effects of hypoxia during an altitude chamber "flight." The FAA provides this opportunity through aviation physiology training, which is conducted at the FAA Civil Aeromedical Institute and at many military facilities across the United States. Pilots can apply for this training by contacting the Physiological Operations and Training Section, AAC-143, FAA Civil Aeromedical Institute, P.O. Box 25082, Oklahoma City, Oklahoma 73125.

(6) Hypoxia is prevented by heeding factors that reduce tolerance to altitude, by enriching the inspired air with oxygen from an appropriate oxygen system and by maintaining a comfortable, safe cabin pressure altitude. For optimum protection, pilots are encouraged to use supplemental oxygen above 10,000 feet during the day, and above 5,000 feet at night. The FARs require that the minimum flight crew be provided with and use supplemental oxygen after 30 minutes of exposure to cabin pressure altitudes between 12,500 and 14,000 feet, and immediately on exposure to cabin pressure altitudes above 14,000 feet. Every occupant of the aircraft must be provided with supplemental oxygen at cabin pressure altitudes above 15,000 feet.

b. Ear Block

(1) As the aircraft cabin pressure decreases during ascent, the expanding air in the middle ear pushes the eustachian tube open and, by escaping down it to the nasal passages, equalizes in pressure with the cabin pressure. But during descent, the pilot must periodically open the eustachian tube to equalize pressure. This can be accomplished by swallowing, yawning, tensing muscles in the throat or, if these do not work, by the combination of clo

ing the mouth, pinching the nose closed and attempting to blow through the nostrils (Valsalva maneuver).

(2) Either an upper respiratory infection, such as a cold or sore throat, or a nasal allergic condition can produce enough congestion around the eustachian tube to make equalization difficult. Consequently, the difference in pressure between the middle ear and aircraft cabin can build up to a level that will hold the eustachian tube closed, making equalization difficult if not impossible. The problem is commonly referred to as an "ear block."

(3) An ear block produces severe ear pain and loss of hearing that can last from several hours to several days. Rupture of the ear drum can occur in flight or after landing. Fluid can accumulate in the middle ear and become infected.

(4) An ear block is prevented by not flying with an upper respiratory infection or nasal allergic condition. Adequate protection is usually not provided by decongestant sprays or drops to reduce congestion around the eustachian tubes. Oral decongestants have side effects that can significantly impair pilot performance.

(5) If an ear block does not clear shortly after landing, a physician should be consulted.

c. Sinus Block

(1) During ascent and descent, air pressure in the sinuses equalizes with the aircraft cabin pressure through small openings that connect the sinuses to the nasal passages. Either an upper respiratory infection, such as a cold or sinusitis, or a nasal allergic condition can produce enough congestion around an opening to slow equalization and, as the difference in pressure between the sinus and cabin mounts, eventually plug the opening. This "sinus block" occurs most frequently during descent.

(2) A sinus block can occur in the frontal sinuses, located above each eyebrow, or in the maxillary sinuses, located in each upper cheek. It will usually produce excruciating pain over the sinus area. A maxillary sinus block can also make the upper teeth ache. Bloody muscus may discharge from the nasal passages.

(3) A sinus block is prevented by not flying with an upper respiratory infection or nasal allergic condition. Adequate protection is usually not provided by decongestant sprays or drops to reduce congestion around the sinus openings. Oral decongestants have side effects that can impair pilot performance.

(4) If a sinus block does not clear shortly after landing, a physician should be consulted.

d. Decompression Sickness After Scuba Diving

(1) A pilot or passenger who intends to fly after scuba diving should allow the body sufficient time to rid itself of excess nitrogen absorbed during diving. If not, decompression sickness due to evolved gas can occur during exposure to low altitude and create a serious in-flight emergency.

(2) The recommended waiting time before flight to cabin pressure altitudes of 8,000 feet or less is at least 4 hours after diving which has not required controlled ascent (nondecompression diving), and at least 24 hours after diving which has required controlled ascent (decompression diving). The waiting time before flight to cabin pressure altitudes above 8,000 feet should be at least 24 hours after any scuba diving.

602. HYPERVENTILATION IN FLIGHT

a. Hyperventilation, or an abnormal increase in the volume of air breathed in and out of the lungs, can occur subconsciously when a stressful situation is encountered in flight. As hyperventilation "blows off" excessive carbon dioxide from the body, a pilot can experience symptoms of lightheadedness, suffocation, drowsiness, tingling in the extremities, and coolness—and react to them with even greater hyperventilation. Incapacitation can eventually result from incoordination, disorientation, and painful muscle spasms. Finally, unconsciousness can occur.

b. The symptoms of hyperventilation subside within a few minutes after the rate and depth of breathing are consciously brought back under control. The buildup of carbon dioxide in the body can be hastened by controlled breathing in and out of a paper bag held over the nose and mouth.

c. Early symptoms of hyperventilation and hypoxia are similar. Moreover, hyperventilation and hypoxia can occur at the same time. Therefore, if a pilot is using an oxygen system when symptoms are experienced, the oxygen regulator should immediately be set to deliver 100 percent oxygen, and then the system checked to assure that it has been functioning effectively before giving attention to rate and depth of breathing.

603. CARBON MONOXIDE POISONING IN FLIGHT

a. Carbon monoxide is a colorless, odorless and tasteless gas contained in exhaust fumes. When breathed even in minute quantities over a period of time, it can significantly reduce the ability of the blood to carry oxygen. Consequently, effects of hypoxia occur.

b. Most heaters in light aircraft work by air flowing over the manifold. Use of these heaters while exhaust fumes are escaping through manifold cracks and seals is responsible every year for several nonfatal and fatal aircraft accidents from carbon monoxide poisoning.

c. A pilot who detects the odor of exhaust or experiences symptoms of headache, drowsiness, or dizziness while using the heater should suspect carbon monoxide poisoning, and immediately shut off the heater and open air vents. If symptoms are severe, or continue after landing, medical treatment should be sought.

604. ILLUSIONS IN FLIGHT

a. Introduction

(1) Many different illusions can be experienced in flight. Some can lead to spatial disorientation. Others can lead to landing errors. Illusions rank among the most common factors cited as contributing to fatal aircraft accidents.

b. Illusions Leading to Spatial Disorientation

(1) Various complex motions and forces and certain visual scenes encountered in flight can create illusions of motion and position. Spatial disorientation from these illusions can be prevented only by visual reference to reliable, fixed points on the ground or to flight instruments.

(2) The leans — An abrupt correction of a banked attitude, which has been entered too slowly to stimulate the motion sensing system in the inner ear, can create the illusion of banking in the opposite direction. The disoriented pilot will roll the aircraft back into its original dangerous attitude or, if level flight is maintained, will feel compelled to lean in the perceived vertical plane until this illusion subsides.

(a) Coriolis illusion — An abrupt head movement in a prolonged constant-rate turn that has ceased stimulating the motion sensing system can create the illusion of rotation or movement in an entirely different axis. The disoriented pilot will maneuver the aircraft into a dangerous attitude in an attempt to stop rotation. This most overwhelming of all illusions in flight may be prevented by not making sudden, extreme head movements, particularly while making prolonged constant-rate turns under IFR conditions.

(b) Graveyard spin — A proper recovery from a spin that has ceased stimulating the motion sensing system can create the illusion of spinning in the opposite direction. The disoriented pilot will return the aircraft to its original spin.

(c) Graveyard spiral— An observed loss of altitude during a coordinated constant-rate turn that has ceased stimulating the motion sensing system can create the illusion of being in a descent with the wings level. The disoriented pilot will pull back on the controls, tightening the spiral and increasing the loss of altitude.

(d) Somatogravic illusion — A rapid acceleration during takeoff can create the illusion of being in a nose up attitude. The disoriented pilot will push the aircraft into a nose low, or dive attitude. A rapid deceleration by a quick reduction of the throttles can have the opposite effect, with the disoriented pilot pulling the aircraft into a nose up, or stall attitude.

(e) Inversion illusion — An abrupt change from climb to straight and level flight can create the illusion of tumbling backwards. The disoriented pilot will push the aircraft abruptly into a nose low attitude, possibly intensifying this illusion.

(f) Elevator illusion — An abrupt upward vertical acceleration, usually by an updraft, can create the illusion of being in a climb. The disoriented pilot will push the aircraft into a nose low attitude. An abrupt downward vertical acceleration, usually by a downdraft, has the opposite effect, with the disoriented pilot pulling the aircraft into a nose up attitude.

(g) False horizon — Sloping cloud formations, an obscured horizon, a dark scene spread with ground lights and stars, and certain geometric patterns of ground light can create illusions of not being aligned correctly wih the actual horizon. The disoriented pilot will place the aircraft in a dangerous attitude.

(h) Autokinesis — In the dark, a static light will appear to move about when stared at for many seconds. The disoriented pilot will lose control of the aircraft in attempting to align it with the light.

(3) Illusions Leading to Landing Errors

(a) Various surface features and atmospheric conditions encountered in landing can create illusions of incorrect height above and distance from the runway threshold. Landing errors from these illusions can be prevented by anticipating them during approaches, aerial visual inspection of unfamiliar airports before landing, using electronic glide slope or VASI systems when available, and maintaining optimum proficiency in landing procedures.

(b) Runway width illusion — a narrower-than-usual runway can create the illusion that the aircraft is at a higher altitude than it actually is. The pilot who does not recognize this illusion will fly a lower approach, with the risk of striking objects along the approach path or landing short. A wider-than-usual runway can have the opposite effect, with the risk of leveling out high and landing hard or overshooting the runway.

(c) Runway and terrain slopes illusion — An upsloping runway, upsloping terrain, or both, can create the illusion that the aircraft is at a higher altitude than it actually is. The pilot who does not recognize this illusion will fly a lower approach. A downsloping runway, downsloping approach terrain, or both, can have the opposite effect.

(d) Featureless terrain illusion — An absence of ground features, as when landing over water, darkened areas and terrain made featureless by snow, can create the illusion that the aircraft is at a higher altitude than it actually is. The pilot who does not recognize this illusion will fly a lower approach.

(e) Atmospheric illusions — Rain on the windscreen can create the illusion of greater height, and atmospheric haze the illusion of being at a greater distance from the runway. The pilot who does not recognize these illusions will fly a lower approach. Penetration of fog can create the illusion of pitching up. The pilot who does not recognize this illusion will steepen the approach, often quite abruptly.

(f) Ground lighting illusions — Lights along a straight path, such as a road, and even lights on moving trains can be mistaken for runway and approach lights. Bright runway and approach lighting systems, especially where few lights illuminate the surrounding terrain, may create the illusion of less distance to the runway. The pilot who does not recognize this illusion will fly a higher approach. Conversely, the pilot overflying terrain which has few lights to provide height cues may make a lower than normal approach.

605. VISION IN FLIGHT

a. Introduction

(1) Of the body senses, vision is the most important for safe flight. Major factors that determine how effectively vision can be used are the level of illumination and the technique of scanning the sky for other aircraft.

b. Vision Under Dim and Bright Illumination

(1) Under conditions of dim illumination, small print and colors on aeronautical charts and aircraft instruments become unreadable unless adequate cockpit lighting is available. Moreover, another aircraft must be much closer to be seen unless its navigation lights are on.

(2) In darkness, vision becomes more sensitive to light, a process called dark adaptation. Although exposure to total darkness for at least 30 minutes is required for complete dark adaptation, the pilot can achieve a moderate degree of dark adaptation within 20 minutes under dim red cockpit lighting. Since red light severely distorts colors,

pecially on aeronautical charts, and can cause serious difficulty in focusing the eyes on objects inside the aircraft, its use is advisable only where optimum outside night vision capability is necessary. Even so, white cockpit lighting must be available when needed for map and instrument reading, especially under IFR conditions. Dark adaptation is impaired by exposure to cabin pressure altitudes above 5,000 feet, carbon monoxide inhaled in smoking and from exhaust fumes, deficiency of Vitamin A in the diet, and by prolonged exposure to bright sunlight. Since any degree of dark adaptation is lost within a few seconds of viewing a bright light, the pilot should close one eye when using a light to preserve some degree of night vision.

(3) Excessive illumination, especially from light reflected off the canopy, surfaces inside the aircraft, clouds, water, snow, and desert terrain, can produce glare, with uncomfortable squinting, watering of the eyes, and even temporary blindness. Sunglasses for protection from glare should absorb at least 85 percent of visible light (15 percent transmittance) and all colors equally (neutral transmittance), with negligible image distortion from refractive and prismatic errors.

c. Scanning for Other Aircraft

(1) Scanning the sky for other aircraft is a key factor in collision avoidance. It should be used continuously by the pilot and copilot (or right seat passenger) to cover all areas of the sky visible from the cockpit. Although pilots must meet specific visual acuity requirements, the ability to read an eye chart does not ensure that one will be able to efficiently spot other aircraft. Pilots must develop an effective scanning technique which maximizes one's visual capabilities. The probability of spotting a potential collision threat obviously increases with the time spent looking outside the cockpit. Thus, one must use timesharing techniques to efficiently scan the surrounding airspace while monitoring instruments as well.

(2) While the eyes can observe an approximate 200 degree arc of the horizon at one glance, only a very small center area called the fovea, in the rear of the eye, has the ability to send clear, sharply focused messages to the brain. All other visual information that is not processed directly through the fovea will be of less detail. An aircraft at a distance of 7 miles which appears in sharp focus within the foveal center of vision would have to be as close as 7/10 of a mile in order to be recognized if it were outside of foveal vision. Because the eyes can focus only on this narrow viewing area, effective scanning is accomplished with a series of short, regularly spaced eye movements that bring successive areas of the sky into the central visual field. Each movement should not exceed 10 degrees, and each area should be observed for at least one second to enable detection. Although horizontal back-and-forth eye movements seem preferred by most pilots, each pilot should develop a scanning pattern that is most comfortable and then adhere to it to assure optimum scanning.

(3) Studies show that the time a pilot spends on visual tasks inside the cabin should represent no more that 1/4 to 1/3 of the scan time outside, or no more than 4 to 5 seconds on the instrument panel for every 16 seconds outside. Since the brain is already trained to process sight information that is presented from left to right, one may find it easier to start scanning over the left shoulder and proceed across the windshield to the right.

(4) Pilots should realize that their eyes may require several seconds to refocus when switching views between items in the cockpit and distant objects. The eyes will also tire more quickly when forced to adjust to distances immediately after close-up focus, as required for scanning the instrument panel. Eye fatique can be reduced by looking from the instrument panel to the left wing past the wing tip to the center of the first scan quandrant when beginning the exterior scan. After having scanned from left to right, allow the eyes to return to the cabin along the right wing from its tip inward. Once back inside, one should automatically commence the panel scan.

(5) Effective scanning also helps avoid "empty-field myopia." This condition usually occurs when flying above the clouds or in a haze layer that provides nothing specific to focus on outside the aircraft. This causes the eyes to relax and seek a comfortable focal distance which may range from 10 to 30 feet. For the pilot, this means looking without seeing, which is dangerous.

606. AEROBATIC FLIGHT

a. Airmen planning to engage in aerobatics should be aware of the physiological stresses associated with accelerative forces during aerobatic maneuvers. Many prospective aerobatic trainees enthusiastically enter aerobatic instruction but find their first experiences with G forces to be unanticipated and very uncomfortable. To minimize or avoid potential adverse effects, the aerobatic instructor and trainee must have a basic understanding of the physiology of G force adaptation.

b. Forces experienced with a rapid push-over maneuver result in the blood and body organs being displaced toward the head. Depending on forces involved and individual tolerance, the airman may experience discomfort, headache, "red-out," and even unconsciousness.

c. Forces experienced with a rapid pull-up maneuver result in the blood and body organ displacement toward the lower part of the body away from the head. Since the brain requires continuous blood circulation for an adequate oxygen supply, there is a physiologic limit to the time the pilot can tolerate higher forces before losing consciousness. As the blood circulation to the brain decreases as a result of forces involved, the airman will experience "narrowing" of visual fields, "gray-out," "black-out," and unconsciousness. Even a brief loss of consciousness in a maneuver can lead to improper control movement causing structural failure of the aircraft or collision with another object or terrain.

d. In steep turns, the centrifugal forces tend to push the pilot into the seat, thereby resulting in blood and body organ displacement toward the lower part of the body as in the case of rapid pull-up maneuvers and with the same physiologic effects and symptoms.

e. Physiologically, humans progressively adapt to imposed strains and stress, and with practice, any maneuver will have decreasing effect. Tolerance to G forces is dependent on human physiology and the individual pilot. These factors include the skeletal anatomy, the cardiovascular architecture, the nervous system, the quality of the blood, the general physical state, and experience and recency of exposure. The airman should consult an Aviation Medical Examiner prior to aerobatic training and be aware that poor

physical condition can reduce tolerance to accelerative forces.

f. The above information provides the airman a brief summary of the physiologic effects of G forces. It does not address methods of "counteracting" these effects. There are numerous references on the subject of G forces during aerobatics available to the airman. Among these are "G Effects on the Pilot During Aerobatics," Office of Aviation Medicine, FAA, Washington, D.C., July 1972 (FAA-AM-72-28). An Advisory Circular is presently being drafted to provide more information on the subject.

607. JUDGMENT ASPECTS OF COLLISION AVOIDANCE

a. Introduction

(1) The most important aspects of vision and the techniques to scan for other aircraft are described in Paragraph 605 above. Pilots should also be familiar with the following information to reduce the possibility of mid-air collisions.

b. Determining Relative Altitude

(1) Use the horizon as a reference point. If the other aircraft is above the horizon, it is probably on a higher flight path. If the aircraft appears to be below the horizon, it is probably flying at a lower altitude.

c. Taking Appropriate Action

(1) Pilots should be familiar with rules on right-of-way, so if an aircraft is on an obvious collision course, one can take immediately evasive action, preferably in compliance with applicable Federal Aviation Regulations.

d. Consider Multiple Threats

(1) The decision to climb, descend, or turn is a matter of personal judgment, but one should anticipate that the other pilot may also be making a quick maneuver. Watch the other aircraft during the maneuver and begin your scanning again immediately since there may be other aircraft in the area.

e. Collision Course Targets

(1) Any aircraft that appears to have no relative motion and stays in one scan quadrant is likely to be on a collision course. Also, if a target shows no lateral or vertical motion, but increases in size, *take evasive action.*

f. Recognize High Hazard Areas

(1) Airways and especially VORs and airport traffic areas are places where aircraft tend to cluster.

(2) Remember, most collisions occur during days when the weather is good. Being in a "radar environment" still requires vigilance to avoid collisions.

g. Cockpit Management

(1) Studying maps, checklists, and manuals before flight, with other proper preflight planning (e.g., noting necessary radio frequencies) and organizing cockpit materials, can reduce the amount of time required to look at these items during flight, permitting more scan time.

h. Windshield Conditions

(1) Dirty or bug-smeared windshields can greatly reduce the ability of pilots to see other aircraft. Keep a clean windshield.

i. Visibility Conditions

(1) Smoke, haze, dust, rain, and flying towards the sun can also greatly reduce the ability to detect targets.

j. Visual Obstructions in the Cockpit

(1) Pilots need to move their heads to see around blind spots caused by fixed aircraft structures, such as door posts, wings, etc. It will be necessary at times to maneuver the aircraft (e.g., lift a wing) to facilitate seeing.

(2) Pilots must insure curtains and other cockpit objects (e.g., maps on glare shield) are removed and stowed during flight.

k. Lights On

(1) Day or night, use of exterior lights can greatly increase the conspicuity of any aircraft.

(2) Keep interior lights low at night.

l. ATC support

(1) ATC facilities often provide radar traffic advisories on a workload-permitting basis. Flight through the new Airport Radar Service Areas (ARSAs) requires communication with ATC. Use this support whenever possible or when required.

608—619. RESERVED

Chapter 8. AERONAUTICAL CHARTS AND RELATED PUBLICATIONS

Section 1. TYPES OF CHARTS AVAILABLE

620. GENERAL

Aeronautical charts for the U.S. and its territories and possessions are produced by the National Ocean Service (NOS), a part of the Department of Commerce, from information furnished by the FAA.

621. OBTAINING AERONAUTICAL CHARTS

En route Aeronautical Charts, En route Supplements, Approach Procedure Charts, Regional Airport/Facility Directories and other publications described in this Chapter are available upon subscription from the:

National Ocean Service
NOAA Distribution Branch (N/CG33)
Riverdale, Maryland 20737

622. TYPES OF CHARTS AVAILABLE

Sectional and VFR Terminal Area Charts
World Aeronautical Charts (U.S.)
En route Low Altitude Charts
En route High Altitude Charts
Alaska En route Charts (Low and High)
Aircraft Position Charts
Planning Charts
Instrument Approach Procedure Charts
Standard Instrument Departure (SID) Charts
Standard Terminal Arrival (STAR) Charts
Alaska Terminal Publication

623. GENERAL DESCRIPTION OF EACH CHART SERIES

a. Sectional and VFR Terminal Area Charts

(1) These charts are designed for visual navigation of slow and medium speed aircraft. They are produced to the following scales:

Sectional Charts — 1:500,000 (1 in=6.86 NM)

VFR Terminal Area Charts — 1:250,000 (1 in=3.43 NM)

(2) Topographic information features the portrayal of relief and a judicious selection of visual check points for VFR flight (Terminal Area Charts include populated places, drainage, roads, railroads, and other distinctive landmarks). Aeronautical information includes visual and radio aids to navigation, aerodromes, controlled airspace, restricted areas, obstructions, and related data. The VFR Terminal Area Charts also depict the airspace designated as "terminal control area" which provides for the control or segregation of all aircraft within the terminal control area. The Puerto Rico-Virgin Islands Terminal Area Chart contains basically the same information as that shown on the Sectional and Terminal Area Chart. It includes the Gulf of Mexico and Caribbean Planning Chart on the reverse side (See PLANNING CHARTS). Charts are revised semiannually except for several Alaskan Sectionals and the Puerto Rico-Virgin Islands Terminal Area which are revised annually.

b. World Aeronautical Charts

(1) These charts are designed to provide a standard series of aeronautical charts, covering land areas of the world, at a size and scale convenient for navigation by moderate speed aircraft. They are produced at a scale of 1:1,000,000 (1 in=13.7 NM). Topographic information includes cities and towns, principal roads, railroads, distinctive landmarks, drainage and relief. The latter is shown by spot elevations, contours, and gradient tints. Aeronautical information includes visual and radio aids to navigation, aerodromes, airways, restricted areas, obstructions and other pertinent data. These charts are revised annually except several Alaskan charts and the Mexican/Caribbean charts which are revised every 2 years.

c. En route Low Altitude Charts

(1) These charts are designed to provide aeronautical information for en route navigation under Instrument Flight Rules (IFR) in the low altitude stratum. The series also includes En route Area Charts which furnish terminal data at a large scale in congested areas, and is included with the subscription to the series. Information includes the portrayal of L/MF and VHF airways, limits of controlled airspace, position, identification and frequencies of radio aids, selected aerodromes, minimum en route and obstruction clearance altitudes, airway distances, reporting points, special use airspace areas, military training routes and related information. Charts are printed back to back. Charts are revised every 56 days effective with the date of airspace changes. An En route Change Notice may be issued as required on the midpoint 28-day cycle.

d. En route High Altitude Charts

(1) These charts are designed to provide aeronautical information for en route navigation under IFR in the high altitude stratum. Information includes the portrayal of jet routes, position, identification and frequencies of radio aids, selected aerodromes, distances, time zones, special use airspace areas and related information. Charts are revised every 56 days effective with the date of airspace changes. An En route Change Notice may be issued as required on the midpoint 28-day cycle.

e. Alaska En route Charts (Low and High)

(1) These charts are produced in a low altitude and high altitude series with purpose and makeup identical to Low and High Altitude Charts described above. Charts are revised every 56 days effective with the date of airspace

changes. An En route Change Notice may be issued as required on the midpoint 28-day cycle.

f. Aircraft Position Charts

(1) These charts are designed to fulfill the requirements for plotting lines of position from celestial observations and electronic aids. They are designed for long-range flights usually over extensive water or desert areas. They are produced at a scale of 1:5,000,000 to 1:6,750,000. Topographic information includes spot elevations, important drainage features, large cities and international boundaries. All en route aeronautical data necessary for overwater flight are provided. This information varies with the area requirements and includes oceanic control areas, flight information regions, weather zones, normal positions of air-sea rescue vessels, and, if required, LORAN and CONSOLAN data. Charts are revised and issued as required.

g. Planning Charts

(1) ***VFR/IFR Planning Chart***

(a) These charts are designed to fulfill the requirements of preflight planning for flights under VFR/IFR. They are produced at a scale of 1:2,333,232 (1 in=32 NM). The chart is printed in two parts in such a manner that, when assembled, it forms a composite VFR Planning Chart on one side and IFR Planning Chart on the other. Information on the IFR chart includes low altitude airways and mileages, navigational facilities, special use airspace areas, time zones, airports, isogonic lines, and related data. Information on the VFR chart includes selected populated places, large bodies of water, major drainage, shaded relief, navigational facilities, airports, special use airspace areas, military training routes and related data.

(2) ***Flight Case Planning Chart***

(a) This chart is designed for preflight and en route flight planning for VFR flights. It is produced at a scale of 1:4,374,803 (1 in=60 NM). This chart contains basically the same information as the VFR/IFR Planning Chart with the addition of selected FSS and Weather Service Offices located at airport sites, parachute jumping areas, a tabulation of special use airspace areas, a mileage table listing distances between 174 major airports and a city/aerodrome location index.

(3) ***Gulf of Mexico and Caribbean Planning Chart***

(a) This chart is designated for preflight planning for VFR flights. It is produced at a scale of 1:6,270,551 (1 in=86 NM). This chart is on the reverse of the Puerto Rico-Virgin Islands Terminal Area Chart. Information includes mileage between Airports of Entry, a selection of special use airspace areas and a Directory of Aerodromes with their available facilities and servicing.

(4) ***Instrument Approach Procedure (IAP) Charts***

(a) IAP charts portray the aeronautical data which is required to execute instrument approaches to airports. These charts are published in 15 bound volumes covering the conterminous U.S. and the Puerto Rico-Virgin Islands. Each new volume is superseded by a new volume each 56 days. Changes to procedures occurring between the 56 day publication cycle is reflected in a change notice volume issued on the 28 day midcycle. These changes are in the form of a new chart. The publication of a new 56 day volume incorporates all the changes and replaces the preceding volume and the change notice. The bound volumes are 5 3/8 x 8 1/4 inches and bound on the top edge. Each chart contained depicts the IAP, all related navigation data, communications information and an airport diagram. Each procedure is designated for use with a specific electronic navigational aid, such as ILS, VOR, NDB, RNAV, etc. Airport Taxi Charts where published, are included.

(5) ***Standard Instrument Departure (SID) Charts***

(a) These charts are designed to expedite clearance delivery and to facilitate transition between takeoff and en route operations. They are published in a bound book, 5 3/8 inches by 8 1/4 inches, and furnish pilots departure routing clearance information in graphic and textual form. These are two bound volumes which are issued every 5 days.

(6) ***Standard Terminal Arrival (STAR) Charts***

(a) These charts are designed to expedite ATC arrival route procedures and to facilitate transition between en route and instrument approach operations. These charts, published in a bound book, 5 3/8 inches by 8 1/4 inches, present to the pilot preplanned IFR ATC arrival route procedures in graphic and textual form. Each STAR procedure is presented as a separate chart and may serve a single airport or more than one airport in a given geographic location. One bound volume of STAR charts for the U.S., excluding Alaska, is issued every 56 days.

(7) ***Alaska Terminal Publication***

(a) This publication contains charts depicting all terminal flight procedures in the State of Alaska for civil and military aviation. They are:

Instrument Approach Procedure (IAP) Charts.
Standard Instrument Departure (SID) Charts.
Standard Terminal Arrival (STAR) Charts.
Airport Taxi Charts.
Radar Minimums.

(b) All supplementary supporting data, i.e.: IFI Takeoff and Departure Procedures, IFR Alternate Mini mums, Rate of Descent Table, Inoperative Component Table, etc., is also included.

(c) The Alaska Terminal is published in a boun book 5 3/8 inches by 8 1/4 inches, and is arranged alpha betically by airport name with all procedures appropriat to the airport following the airport name: STAR, IAI TAXI, SID. The publication is issued every 56 days wit provisions for an as required "Terminal Change" on the 2 day midpoint.

624. RELATED PUBLICATIONS

a. The Airport Facility Directory

(1) This directory is issued in seven volumes wit each volume covering a specific geographic area of the co terminous U.S., including Puerto Rico and the U.S. Virgi Islands. The directory is 5 3/8 X 8 1/4 inches and is boun on the side. Each volume is reissued in its entirety each 5 days. Each volume is indexed alphabetically by state, ai port, navigational aid, and ATC facility for the area of co erage. All pertinent information concerning each entry included.

b. Alaska Supplement

(1) This supplement is a joint Civil and Militar Flight Information Publication (FLIP), published and di tributed every 56 days by the NOS. It is designed for use with the Flight Information Publication En route Charts, Alaska Terminal, WAC and Sectional Aeronautical Charts. This Supplement contains an Airport/Facility Directory of all airports shown on En route Charts, and those requested by appropriate agencies, communications data, navigational facilities, special notices and procedures applicable to the area of chart coverage.

c. Pacific Supplement

(1) This Chart Supplement is a Civil Flight Information Publication, published and distributed every 56 days by the NOS. It is designed for use with the Flight Information En route Publication Charts and the Sectional Aeronautical Chart covering the State of Hawaii and that area of the Pacific served by U.S. facilities. An Amendment Notice is published 4 weeks after each issue of the Supplement. This chart Supplement contains an Airport/Facility Directory of all airports open to the public, and those requested by appropriate agencies, communications data, navigational facilities, special notices and procedures applicable to the Pacific area.

d. Defense Mapping Agency Aerospace Center (DMAAC) Publications

(1) Pilotage Charts (PC/TPC) — Scale 1:500,000 used for detail preflight planning and mission analysis. Emphasis in design is on ground features significant in visual and radar, low-level high speed navigation.

(2) Jet Navigation Charts (JNC-A) — Scale 1:3,000,000. Designed to provide greater coverage than the 1:2,000,000 scale Jet Navigation Charts described below. Uses include preflight planning and en route navigation by long-range jet aircraft with dead reckoning, radar, celestial and grid navigation capabilities.

(3) LORAN Navigation & Consol LORAN Navigation Charts (LJC/CJC) — Scale 1:2,000,000. Used for preflight planning and in-flight navigation on long-range flights in the Polar areas and adjacent regions utilizing LORAN and Consol navigation aids.

(4) Continental Entry Chart (CEC) — Scale 1:2,000,000. Used for CONSOLAN and LORAN navigation for entry into the U.S. when a high degree of accuracy is required to comply with Air Defense identification and reporting procedures. Also suitable as a basic dead reckoning sheet and for celestial navigation.

(5) Aerospace Planning Chart (ASC) — Scale 1:9,000,000 and 1:18,000,000. Six charts at each scale and with various projections, cover the world. Charts are useful for general planning, briefings, and studies.

(6) Air Distance/Geography Chart (GH-2, 2a) — Scales 1:25,000,000 and 1:50,000,000. This chart shows great circle distances between major airports. It also shows major cities, international boundaries, shaded relief and gradient tints.

(7) LORAN C Navigation Chart (LCC) — Scale 1:3,000,000. Primarily designed for preflight and in-flight long-range navigation where LORAN C is used as the basic navigation aid.

(8) DOD Weather Plotting Chart (WPC) — Various scales. Designed as nonnavigational outline charts which depict locations and identifications of meterological observing stations. Primarily used to forecast and monitor weather and atmospheric conditions throughout the world.

(9) Flight Information Publications (FLIP) — These include En route Low Altitude and High Altitude Charts, En route Supplements, Terminal (Instrument Approach Charts), and other informational publications for various areas of the world.

NOTE.— FLIP. Terminal publications do not necessarily include all instrument approach procedures for all airports. They include only those required for military operations. More complete information and price may be obtained from National Ocean Service, Distribution Branch.

(10) World Aeronautical (WAC) and Operational Navigation Charts (ONC) — The Operational Navigation Charts (ONC) have the same purpose and contain essentially the same information as the WAC series except the terrain is portrayed by shaded relief as well as contours. The ONC series is replacing the WAC series and the WAC's will be available only where the ONC's have not been issued. ONC's are 42 X 57 1/2 inches, WAC's are 22 X 30 inches. These charts are revised on a regular schedule.

(11) Jet Navigation Charts — These charts are designed to fulfill the requirements for long-range high altitude, high speed navigation. They are produced at a scale of 1:2,000,000 (1 in=27.4 NM). Topographic features include large cities, roads, railroads, drainage and relief. The latter is indicated by contours, spot elevations and gradient tints. All aeronautical information necessary to conform to the purpose of the chart is shown. This includes restricted areas, L/MF and VOR ranges, radio beacons and a selection of standard broadcasting stations and aerodromes. The runway patterns of the aerodromes are shown to exaggerated scale in order that they may be readily identified as visual landmarks. Universal Jet Navigation Charts are used as plotting charts in the training and practice of celestial and dead reckoning navigation. They may also be used for grid navigational training.

(12) Global Navigational Charts — These charts are designed to fulfill the requirements for aeronautical planning, operations over long distances, and en route navigation in long-range, high altitude, high speed aircraft. They are produced at a scale of 1:5,000,000 (1 in=68.58 NM). Global Navigation Charts (GNC) are 42 by 57 1/2 inches. They show principal cities, towns and drainage, primary roads and railroads, prominent culture and shadient relief augmented with tints and spot elevations. Aeronautical data includes radio aids to navigation, aerodrome and restricted areas. Charts 1 and 26 have a polar navigation grid and charts 2 and 6 have sub-polar navigation grids. Global LORAN Navigation Charts (GLC) are the same size and scale and cover the same area as the GNC charts. They contain major cities only, coast lines, major lakes and rivers, and land tint. No relief or vegetation. Aeronautical data includes radio aids to navigation and LORAN lines of position.

625. AUXILIARY CHARTS

a. Airport Obstruction Charts (OC):

(1) These large scale (1:12,000) charts of airports show runways and flight paths for landing and takeoff, together with the positions and elevations of the objects which are potential hazards to these operations. The charts are used in determining the maximum safe takeoff and landing gross weight of civil aircraft, in determining airport instrument approach and landing procedures, and to provide data for engineering plans relative to clearing of obstructions and improvement of airport facilities.

b. Military Training Routes:

(1) Charts and Booklet: The Defense Mapping Agency Aerospace Center (DMAAC) publishes a narrative description in booklet form and charts depicting the IFR and VFR Training Routes.

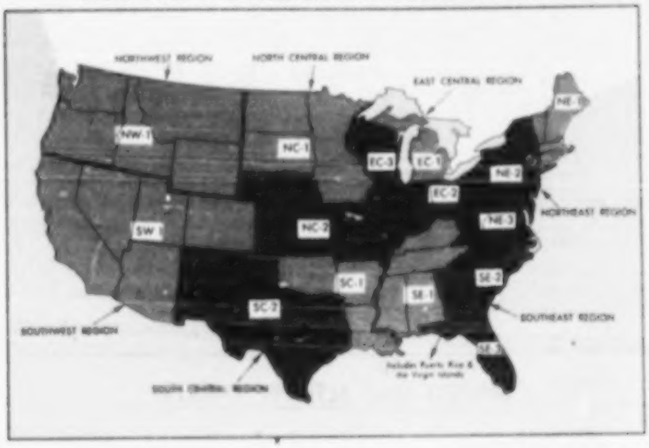
(2) The charts and booklet are published every 56 days. Both the charts and narrative route description booklet are available to the general public as a brochure by single copy or annual subscription.

(3) Subscription and single-copy requests should be for the "DOD Area Planning AP/1B, Military Training Routes".

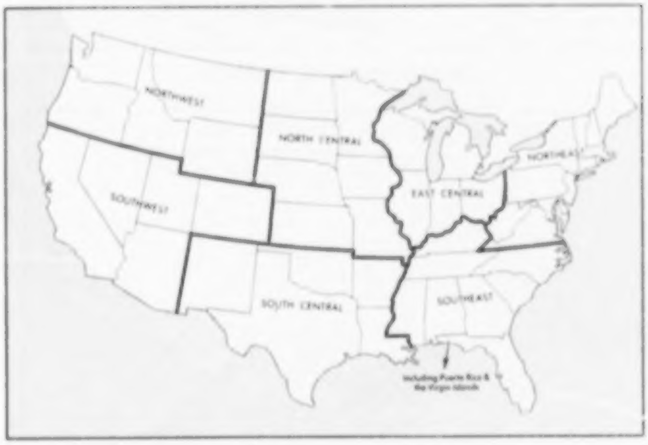
NOTE.— The DOD provides these booklets and charts to each FSS for use in preflight pilot briefings. Pilots should review this information to acquaint themselves with those routes that are located along their route of flight and in the vicinity of the airports from which they operate.

626—999. RESERVED

INSTRUMENT APPROACH PROCEDURE CHARTS


NORTHWEST REGION
NORTH CENTRAL REGION
EAST CENTRAL REGION
NE-1
NW-1
NC-1
EC-3
EC-1
NE-2
EC-2
NORTHEAST REGION
NE-3
SW-1
NC-2
SC-1
SE-2
SE-1
SC-2
SOUTHEAST REGION
SOUTHWEST REGION
SE-3
Includes Puerto Rico & the Virgin Islands
SOUTH CENTRAL REGION

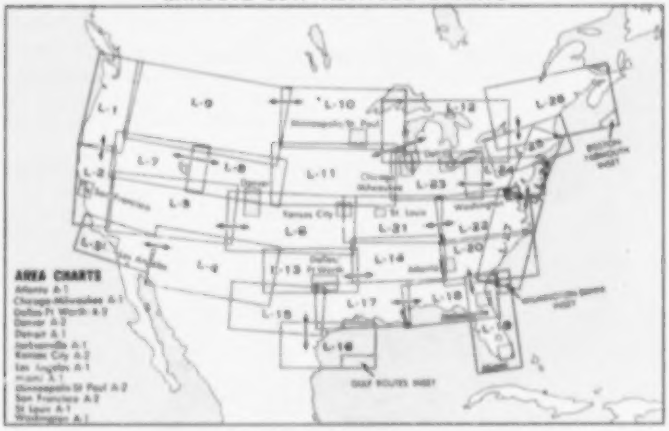
AIRPORT/FACILITY DIRECTORY


NORTHWEST
NORTH CENTRAL
NORTHEAST
SOUTHWEST
EAST CENTRAL
SOUTH CENTRAL
SOUTHEAST
Including Puerto Rico & the Virgin Islands

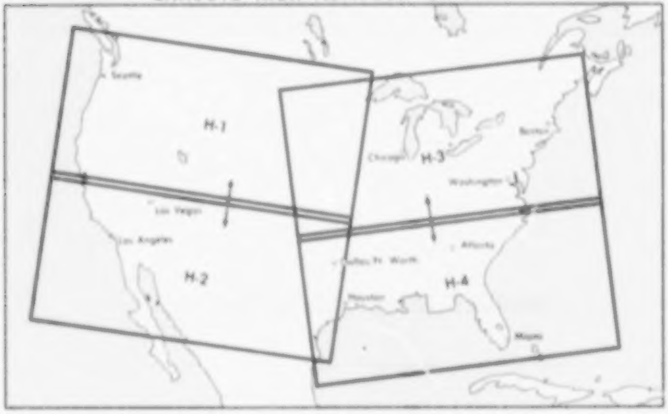
Para—999.

TYPES OF CHARTS AVAILABLE

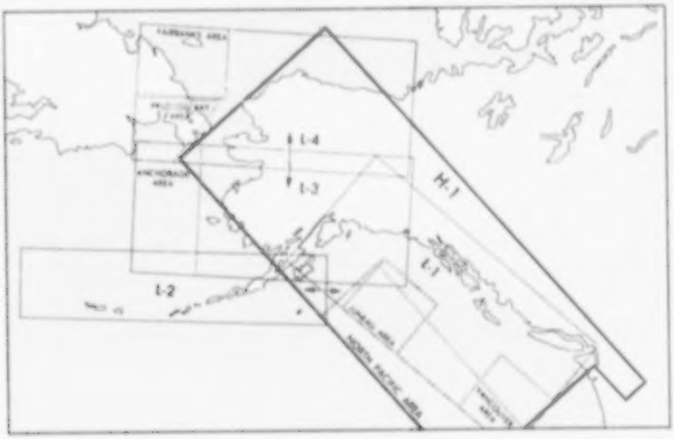
ENROUTE LOW ALTITUDE CHARTS


L-1
L-9
L-10
L-12
L-28
L-7
L-8
L-11
L-23
L-24
L-25
L-2
San Francisco
L-5
Kansas City
St Louis
L-6
L-21
L-22
Washington
L-31
Los Angeles
L-4
L-13
Dallas Ft Worth
L-14
Atlanta
L-20
L-15
L-17
L-18
L-16
L-19
GULF ROUTES INSET
AREA CHARTS
Atlanta A-1
Chicago-Milwaukee A-1
Dallas-Ft Worth A-2
Denver A-2
Detroit A-1
Jacksonville A-1
Kansas City A-2
Los Angeles A-1
Miami A-1
Minneapolis-St Paul A-2
San Francisco A-2
St Louis A-1
Washington A-1

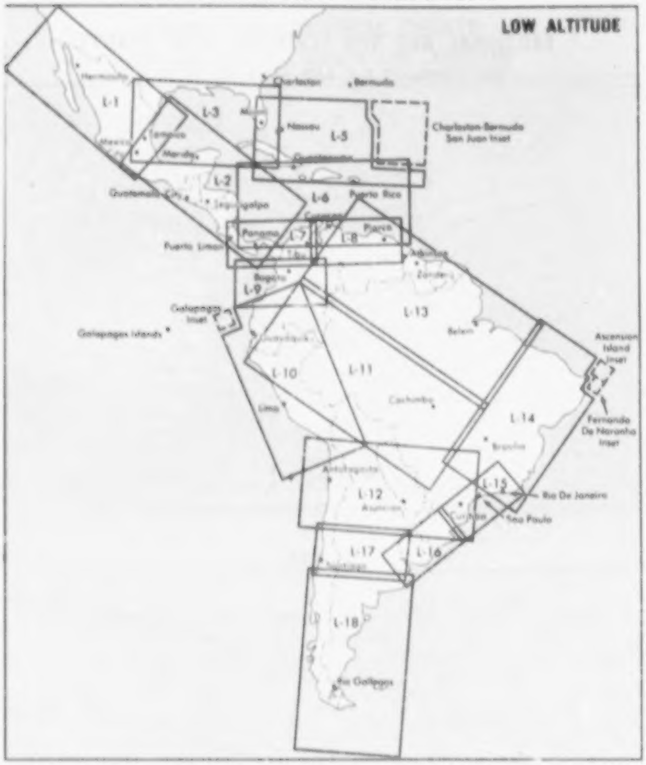
ENROUTE HIGH ALTITUDE CHARTS


Seattle
H-1
Las Vegas
Los Angeles
H-2
Chicago
H-3
Boston
Washington
Dallas-Ft Worth
Atlanta
H-4
Houston
Miami

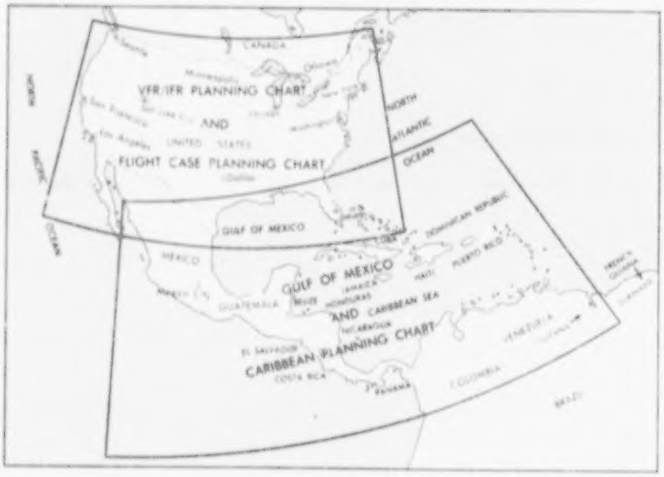
ALASKA ENROUTE CHARTS


FAIRBANKS AREA
ANCHORAGE AREA
L-4
L-3
H-1
L-1
L-2
JUNEAU AREA
NORTH PACIFIC AREA

FLIGHT INFORMATION PUBLICATIONS
CARIBBEAN AND SOUTH AMERICA ENROUTE


LOW ALTITUDE
Hermosillo
L-1
L-3
Miami
Charleston
Bermuda
Nassau
L-5
Charleston-Bermuda San Juan Inset
Tampico
Mexico
Merida
Guantanamo
L-2
Guatemala City
Tegucigalpa
L-6
Puerto Rico
Caracas
Panama
L-7
L-8
Piarco
Puerto Limon
Atkinson
Zandery
Bogota
L-9
Galapagos Inset
Galapagos Islands
L-13
Belem
Ascension Island Inset
Guayaquil
L-10
L-11
Cachimbo
Fernando De Noronha Inset
Lima
L-14
Brasilia
Antofagasta
L-12
Asuncion
L-15
Rio De Janeiro
Curitiba
Sao Paulo
L-17
L-16
Santiago
L-18
Rio Gallegos

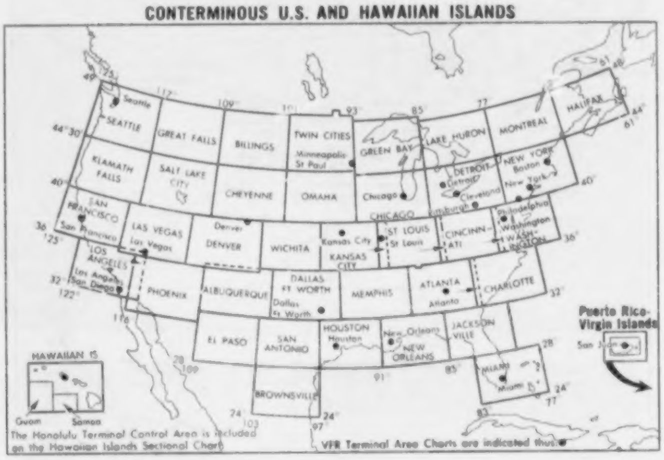
PLANNING CHARTS


CANADA
Seattle
Minneapolis
Ottawa
VFR/IFR PLANNING CHART
AND
FLIGHT CASE PLANNING CHART
San Francisco
Salt Lake City
Chicago
New York
Washington
Los Angeles
UNITED STATES
Dallas
NORTH PACIFIC OCEAN
NORTH ATLANTIC OCEAN
GULF OF MEXICO
MEXICO
Mexico City
CUBA
DOMINICAN REPUBLIC
GULF OF MEXICO
AND CARIBBEAN SEA
CARIBBEAN PLANNING CHART
GUATEMALA
BELIZE
HONDURAS
JAMAICA
HAITI
PUERTO RICO
NICARAGUA
EL SALVADOR
COSTA RICA
PANAMA
COLOMBIA
VENEZUELA
FRENCH GUIANA
BRAZIL

TYPES OF CHARTS AVAILABLE

SECTIONAL AND VFR TERMINAL AREA CHARTS

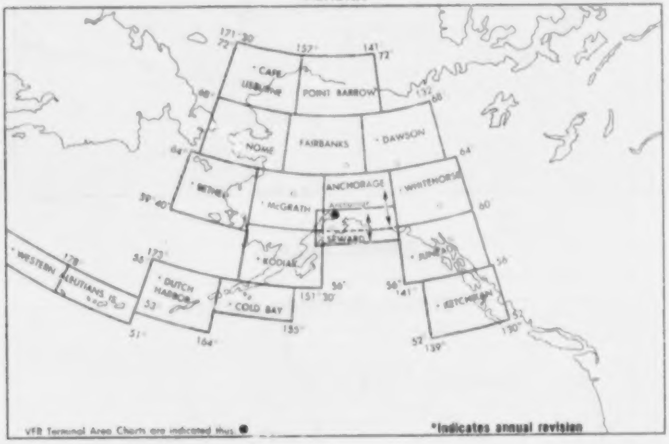
CONTERMINOUS U.S. AND HAWAIIAN ISLANDS


SEATTLE
Seattle
GREAT FALLS
BILLINGS
TWIN CITIES
Minneapolis St Paul
GREEN BAY
LAKE HURON
MONTREAL
HALIFAX
KLAMATH FALLS
SALT LAKE CITY
CHEYENNE
OMAHA
Chicago
CHICAGO
DETROIT
Detroit
Cleveland
Pittsburgh
NEW YORK
Boston
New York
Philadelphia
Washington
WASHINGTON
SAN FRANCISCO
San Francisco
LAS VEGAS
Las Vegas
Denver
DENVER
WICHITA
Kansas City
KANSAS CITY
ST LOUIS
St Louis
CINCINNATI
LOS ANGELES
Los Angeles
San Diego
PHOENIX
ALBUQUERQUE
DALLAS FT WORTH
Dallas Ft Worth
MEMPHIS
ATLANTA
Atlanta
CHARLOTTE
EL PASO
SAN ANTONIO
HOUSTON
Houston
New Orleans
NEW ORLEANS
JACKSONVILLE
MIAMI
Miami
BROWNSVILLE
HAWAIIAN IS
Guam
Samoa
Puerto Rico-Virgin Islands
San Juan
49°
44°30'
40°
36°
32°
125°
122°
117°
109°
101°
93°
85°
77°
61°
48°
44°
40°
36°
32°
28°
24°
115°
109°
103°
97°
91°
85°
83°
77°

The Honolulu Terminal Control Area is included on the Hawaiian Islands Sectional Chart

VFR Terminal Area Charts are indicated thus: ●

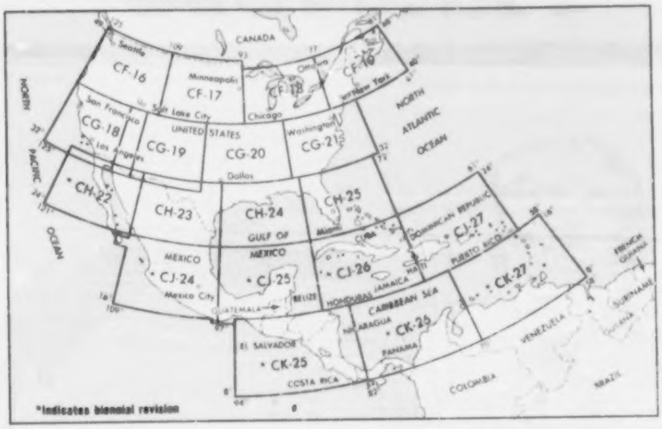
ALASKA


* CAPE LISBURNE
POINT BARROW
NOME
FAIRBANKS
* DAWSON
* BETHEL
* McGRATH
ANCHORAGE
Anchorage
* WHITEHORSE
SEWARD
* KODIAK
* JUNEAU
* WESTERN ALEUTIANS IS
* DUTCH HARBOR
* COLD BAY
* KETCHIKAN
171°30'
72°
157°
141°
72°
132°
68°
68°
64°
64°
59°40'
60°
56°
173°
179°
56°
53°
51°
164°
151°30'
155°
56°
141°
56°
52°
139°
130°
52°

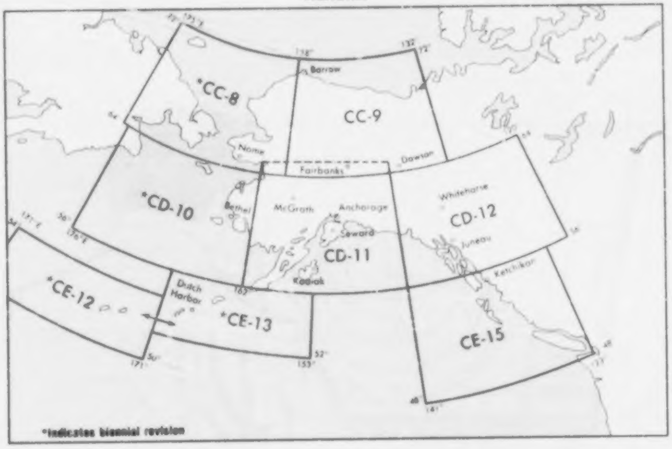
VFR Terminal Area Charts are indicated thus: ●

*Indicates annual revision

WORLD AERONAUTICAL CHARTS
CONTERMINOUS U.S., MEXICO. AND CARIBBEAN


CANADA
CF-16
CF-17
CF-18
CF-19
Seattle
Minneapolis
Ottawa
New York
Salt Lake City
Chicago
San Francisco
Los Angeles
CG-18
CG-19
UNITED STATES
CG-20
Washington
CG-21
NORTH ATLANTIC OCEAN
NORTH PACIFIC OCEAN
Dallas
*CH-22
CH-23
CH-24
CH-25
GULF OF MEXICO
Miami
CUBA
DOMINICAN REPUBLIC
*CJ-27
PUERTO RICO
MEXICO
*CJ-24
Mexico City
*CJ-25
*CJ-26
BELIZE
HONDURAS
JAMAICA
HAITI
*CK-27
FRENCH GUIANA
SURINAME
GUATEMALA
CARIBBEAN SEA
NICARAGUA
*CK-26
VENEZUELA
GUYANA
EL SALVADOR
*CK-25
PANAMA
COSTA RICA
COLOMBIA
BRAZIL
*Indicates biennial revision

ALASKA


*CC-8
Barrow
CC-9
Nome
Dawson
Fairbanks
*CD-10
Bethel
McGrath
Anchorage
Whitehorse
CD-12
Seward
Juneau
CD-11
Kodiak
Ketchikan
*CE-12
Dutch Harbor
*CE-13
CE-15
*Indicates biennial revision

NOTES

PILOT/CONTROLLER GLOSSARY

U.S. Department of Transportation

Federal Aviation Administration

PILOT/CONTROLLER GLOSSARY

JANUARY 16, 1986

This Glossary was compiled to promote a common understanding of the terms used in the Air Traffic Control system. It includes those terms which are intended for pilot/controller communications. Those terms most frequently used in pilot/controller communications are printed in ***bold italics***. The definitions are primarily defined in an operational sense applicable to both users and operators of the National Airspace System. Use of the Glossary will preclude any misunderstandings concerning the system's design, function, and purpose.

Because of the international nature of flying, terms used in the "Lexicon," published by the International Civil Aviation Organization (ICAO), are included when they differ from FAA definitions. These terms are *italicized*. For the reader's convenience, there are also cross references to related terms in other parts of the Glossary and to other documents, such as the Federal Aviation Regulations (FAR's) and the Airman's Information Manual (AIM).

This Glossary will be revised as necessary to maintain a common understanding of the system.

ABBREVIATED IFR FLIGHT PLANS— An authorization by ATC requiring pilots to submit only that information needed for the purpose of ATC. It includes only a small portion of the usual IFR flight plan information. In certain instances, this may be only aircraft identification, location, and pilot request. Other information may be by aircraft which are airborne and desire an instrument approach or by aircraft which are on the ground and desire a climb to VFR-on-top. (See VFR-ON-TOP) (Refer to AIM)

ABEAM— An aircraft is "abeam" a fix, point, or object when that fix, point, or object is approximately 90 degrees to the right or left of the aircraft track. Abeam indicates a general position rather than a precise point.

ABORT— To terminate a preplanned aircraft maneuver; e.g., an aborted takeoff.

ACKNOWLEDGE— Let me know that you have received my message.

ICAO—ACKNOWLEDGE— Let me know that you have received and understood this message.

ACROBATIC FLIGHT— An intentional maneuver involving an abrupt change in an aircraft's attitude, an abnormal attitude, or abnormal acceleration not necessary for normal flight. (Refer to FAR Part 91)

*ICAO—ACROBATIC FLIGHT—*Maneuvers intentionally performed by an aircraft involving an abrupt change in its attitude, an abnormal attitude, or an abnormal variation in speed.

ADDITIONAL SERVICES— Advisory information provided by ATC which includes but is not limited to the following:

1. Traffic advisories.
2. Vectors, when requested by the pilot, to assist aircraft receiving traffic advisories to avoid observed traffic.
3. Altitude deviation information of 300 feet or more from an assigned altitude as observed on a verified (reading correctly) automatic altitude readout (Mode C).
4. Advisories that traffic is no longer a factor.
5. Weather and chaff information.
6. Weather assistance.
7. Bird activity information.
8. Holding pattern surveillance.

Additional services are provided to the extent possible contingent only upon the controller's capability to fit them into the performance of higher priority duties and on the basis of limitations of the radar, volume of traffic, frequency congestion, and controller workload. The controller has complete discretion for determining if he is able to provide or continue to provide a service in a particular case. The controller's reason not to provide or continue to provide a service in a particular case is not subject to question by the pilot and need not be made known to him. (See Traffic Advisories) (Refer to AIM)

ADMINISTRATOR— The Federal Aviation Administrator or any person to whom he has delegated his authority in the matter concerned.

ADVISE INTENTIONS— Tell me what you plan to do.

ADVISORY— Advice and information provided to assist pilots in the safe conduct of flight and aircraft movement. (See Advisory Service)

ADVISORY FREQUENCY— The appropriate frequency to be used for Airport Advisory Service. (See Airport Advisory Service and UNICOM) (Refer to Advisory Circular No. 90-42 and AIM)

ADVISORY SERVICE— Advice and information provided by a facility to assist pilots in the safe conduct of flight and aircraft movement. (See Airport Advisory Service, Traffic Advisories, Safety Alerts, Additional Services, Radar Advisory, En Route Flight Advisory Service) (Refer to AIM)

AERIAL REFUELING/IN-FLIGHT REFUELING— A procedure used by the military to transfer fuel from one aircraft to another during flight. (Refer to VFR/IFR Wall Planning Charts).

AERODROME— A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure, and movement of aircraft.

AERONAUTICAL BEACON— A visual NAVAID displaying flashes of white and/or colored light to indicate the location of an airport, a heliport, a landmark, a certain point of a Federal airway in mountainous terrain, or an obstruction. (See Airport Rotating Beacon) (Refer to AIM)

AERONAUTICAL CHART— A map used in air navigation containing all or part of the following: Topographic features, hazards and obstructions, navigation aids, navigation routes, designated airspace, and airports. Commonly used aeronautical charts are:

1. Sectional Charts—1:500,000—Designed for visual navigation of slow or medium speed aircraft. Topographic information on these charts features the portrayal of relief and a judicious selection of visual check points for VFR flight. Aeronautical information includes visual and radio aids to navigation, airports, controlled airspace, restricted areas, obstructions, and related data.
2. VFR Terminal Area Charts—1:250,000—Depict Terminal Control Area (TCA) airspace which provides for the control or segregation of all the aircraft within the TCA. The chart depicts topographic information and aeronautical information which includes visual and radio aids to navigation, airports, controlled airspace, restricted areas, obstructions, and related data.
3. World Aeronautical Charts (WAC)—1:1,000,000—Provide a standard series of aeronautical charts covering land areas of the world at a size and scale convenient for navigation by moderate speed aircraft. Topographic information includes cities and towns, principal roads, railroads, distinctive landmarks, drainage, and relief. Aeronautical information includes visual and radio aids to navigation, airports, airways, restricted areas, obstructions, and other pertinent data.
4. En Route Low Altitude Charts—Provide aeronautical information for en route instrument navigation (IFR) in the low altitude stratum. Information includes the portrayal of airways, limits of controlled airspace, position identification and frequencies of radio aids, selected airports, minimum en route and minimum obstruction clearance altitudes, airway distances, reporting points, restricted areas, and related data. Area charts, which are a part of this series, furnish terminal data at a larger scale in congested areas.
5. En Route High Altitude Charts—Provide aeronautical information for en route instrument navigation (IFR) in the high altitude stratum. Information includes the portrayal of jet routes, identification and frequencies of radio aids, selected airports, distances, time zones, special use airspace, and related information.
6. Instrument Approach Procedures (IAP) Charts—Portray the aeronautical data which is required to execute an instrument approach to an airport. These charts depict the procedures, including all related data, and the airport diagram. Each procedure is designated for use with a specific type of electronic navigation system including NDB, TACAN, VOR, ILS/MLS, and RNAV. These charts are identified by the type of navigational aid(s) which provide final approach guidance.
7. Standard Instrument Departure (SID) Charts—Designed to expedite clearance delivery and to facilitate transition between takeoff and en route operations. Each SID procedure is presented as a separate chart and may serve a single airport or more than one airport in a given geographical location.
8. Standard Terminal Arrival (STAR) Charts— Designed to expedite air traffic control arrival procedures and to facilitate transition between en route and instrument approach operations. Each STAR procedure is presented as a separate chart and may serve a single airport or more than one airport in a given geographical location.
9. Airport Taxi Charts—Designed to expedite the efficient and safe flow of ground traffic at an airport. These charts are identified by the official airport name; e.g., Washington National Airport.

ICAO—AERONAUTICAL CHART—A representation of a portion of the earth, its culture and relief, specifically designated to meet the requirements of air navigation.

AFFIRMATIVE— Yes.

AIR CARRIER DISTRICT OFFICE/ACDO— An FAA field office serving an assigned geographical area, staffed with Flight Standards personnel serving the aviation industry and the general public on matters related to the certification and operation of scheduled air carriers and other large aircraft operations.

AIRCRAFT— Device/s that are used or intended to be used for flight in the air, and when used in air traffic control terminology, may include the flight crew.

ICAO-AIRCRAFT—Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface.

AIRCRAFT APPROACH CATEGORY— A grouping of aircraft based on a speed of 1.3 times the stall speed in the landing configuration at maximum gross landing weight. An aircraft shall fit in only one category. If it is necessary to maneuver at speeds in excess of the upper limit of a speed range for a category, the minimums for the next higher category should be used. For example, an aircraft which falls in Category A, but is circling to land at a speed in excess of 91 knots, should use the approach Category B minimums when circling to land. The categories are as follows:

1. Category A—Speed less than 91 knots.
2. Category B—Speed 91 knots or more but less than 121 knots.
3. Category C—Speed 121 knots or more but less than 141 knots.
4. Category D—Speed 141 knots or more but less than 166 knots.
5. Category E—Speed 166 knots or more.

(Refer to FAR Parts 1 and 97)

AIRCRAFT CLASSES— For the purposes of Wake Turbulence Separation Minima, ATC classifies aircraft as Heavy, Large, and Small as follows:

1. Heavy—Aircraft capable of takeoff weights of 300,000 pounds or more whether or not they are operating at this weight during a particular phase of flight.
2. Large—Aircraft of more than 12,500 pounds, maximum certificated takeoff weight, up to 300,000 pounds.
3. Small—Aircraft of 12,500 pounds or less maximum certificated takeoff weight. (Refer to AIM)

AIR DEFENSE EMERGENCY— A military emergency condition declared by a designated authority. This condition exists when an attack upon the continental U.S., Alaska, Canada, or U.S. installations in Greenland by hostile aircraft or missiles is considered probable, is imminent, or is taking place. (Refer to AIM)

AIR DEFENSE IDENTIFICATION ZONE/ADIZ— The area of airspace over land or water, extending upward from the surface, within which the ready identification, the location, and the control of aircraft are required in the interest of national security.

1. Domestic Air Defense Identification Zone— An ADIZ within the United States along an international boundary of the United States.
2. Coastal Air Defense Identification Zone— An ADIZ over the coastal waters of the United States.
3. Distant Early Warning Identification Zone (DEWIZ)— An ADIZ over the coastal waters of the State of Alaska.

   ADIZ locations and operating and flight plan requirements for civil aircraft operations are specified in FAR Part 99. (Refer to AIM)

AIRMAN'S INFORMATION MANUAL/AIM— A publication containing Basic Flight Information and ATC Procedures designed primarily as a pilot's instructional manual for use in the National Airspace System of the United States.

ICAO-AERONAUTICAL INFORMATION PUBLICATION—A publication issued by or with the authority of a state and containing aeronautical information of a lasting character essential to air navigation.

AIRMET/WA/AIRMAN'S METEOROLOGICAL INFORMATION— In-flight weather advisories issued only to amend the area forecast concerning weather phenomena which are of operational interest to all aircraft and potentially hazardous to aircraft having limited capability because of lack of equipment, instrumentation, or pilot qualifications. AIRMET's concern weather of less severity than that covered by SIGMET's or Convective SIGMET's. AIRMET's cover moderate icing, moderate turbulence, sustained winds of 30 knots or more at the surface, widespread areas of ceilings less than 1,000 feet and/or visibility less than 3 miles, and extensive mountain obscurement. (See SIGMET and Convective SIGMET) (Refer to AIM)

AIR NAVIGATION FACILITY— Any facility used in, available for use in, or designed for use in, aid of air navigation, including landing areas, lights, any apparatus or equipment for disseminating weather information, for signaling, for radio-directional finding, or for radio or other electrical communication, and any other structure or mechanism having a similar purpose for guiding or controlling flight in the air or the landing and take-off of aircraft. (See Navigational Aid)

AIRPORT— An area on land or water that is used or intended to be used for the landing and takeoff of aircraft and includes its buildings and facilities, if any.

AIRPORT ADVISORY AREA— The area within ten miles of an airport without a control tower or where the tower is not in operation, and on which a Flight Service Station is located. (See Airport Advisory Service) (Refer to AIM)

AIRPORT ADVISORY SERVICE/AAS— A service provided by flight service stations located at airports not serviced by a control tower. This service consists of providing information to arriving and departing aircraft concerning wind direction and speed, favored runway, altimeter setting, pertinent known traffic, pertinent known field conditions, airport taxi routes and traffic patterns, and authorized instrument approach procedures. This information is advisory in nature and does not constitute an ATC clearance. (See Airport Advisory Area)

AIRPORT ELEVATION/FIELD ELEVATION— The highest point of an airport's usable runways measured in feet from mean sea level. (See Touchdown Zone Elevation)

ICAO-AERODROME ELEVATION—The elevation of the highest point of the landing area.

AIRPORT/FACILITY DIRECTORY— A publication designed primarily as a pilot's operational manual containing all airports, seaplane bases, and heliports open to the public including communications data, navigational facilities, and certain special notices and procedures. This publication is issued in seven volumes according to geographical area.

AIRPORT INFORMATION DESK/AID— An airport unmanned facility designed for pilot self-service briefing, flight planning, and filing of flight plans. (Refer to AIM)

AIRPORT LIGHTING— Various lighting aids that may be installed on an airport. Types of airport lighting include:

1. Approach Light System/ALS—An airport lighting facility which provides visual guidance to landing aircraft by radiating light beams in a directional pattern by which the pilot aligns the aircraft with the extended centerline of the runway on his final approach for landing.

   Condenser-Discharge Sequential Flashing Lights/Sequenced Flashing Lights may be installed in conjunction with the ALS at some airports. Types of Approach Light Systems are:

   a. ALSF-I—Approach Light System with Sequenced Flashing Lights in ILS Cat-I configuration.
   b. ALSF-II—Approach Light System with Sequenced Flashing Lights in ILS Cat-II configuration.
   c. SSALF—Simplified Short Approach Light System with Sequenced Flashing Lights.
   d. SSALR—Simplified Short Approach Light System with Runway Alignment Indicator Lights.
   e. MALSF—Medium Intensity Approach Light System with Sequenced Flashing Lights.
   f. MALSR—Medium Intensity Approach Light System with Runway Alignment Indicator Lights.
   g. LDIN—Sequenced Flashing Lead-in Lights.
   h. RAIL—Runway Alignment Indicator Lights (Sequenced Flashing Lights which are installed only in combination with other light systems).
   i. ODALS—Omnidirectional Approach Lighting System consists of seven omnidirectional flashing lights located in the approach area of a nonprecision runway. Five lights are located on the runway centerline extended with the first light located 300 feet from the threshold and extending at equal intervals up to 1,500 feet from the threshold. The other two lights are located, one on each side of the runway threshold, at a lateral distance of 40 feet from the runway edge, or 75 feet from the runway edge when installed on a runway equipped with a VASI. (Refer to Order 6850.2A)

2. Runway Lights/Runway Edge Lights—Lights having a prescribed angle of emission used to define the lateral limits of a runway. Runway lights are uniformly spaced at intervals of approximately 200 feet, and the intensity may be controlled or preset.

3. Touchdown Zone Lighting—Two rows of tranverse light bars located symmetrically about the runway centerline normally at 100 foot intervals. The basic system extends 3,000 feet along the runway.

4. Runway Centerline Lighting—Flush centerline lights spaced at 50-foot intervals beginning 75 feet from the landing threshold and extending to within 75 feet of the opposite end of the runway.

5. Threshold Lights—Fixed green lights arranged symmetrically left and right of the runway centerline, identifying the runway threshold.

6. Runway End Identifier Lights/REIL—Two synchronized flashing lights, one on each side of the runway threshold, which provide rapid and positive identification of the approach end of a particular runway.

7. Visual Approach Slope Indicator/VASI— An airport lighting facility providing vertical visual approach slope guidance to aircraft during approach to landing by radiating a directional pattern of high intensity red and white focused light beams which indicate to the pilot that he is "on path" if he sees red/white, "above path' if white/white, and "below path" if red/red. Some airports serving large aircraft have three-bar VASIs which provide two visual glide paths to the same runway.

8. Boundary Lights—Lights defining the perimeter of an airport or landing area. (Refer to AIM)

AIRPORT MARKING AIDS— Markings used on runway and taxiway surfaces to identify a specific runway, a runway threshold, a centerline, a hold line, etc. A runway should be marked in accordance with its present usage such as:

1. Visual.

2. Nonprecision instrument.

3. Precision instrument. (Refer to AIM)

AIRPORT RADAR SERVICE AREA / ARSA— (See Controlled Airspace)

AIRPORT ROTATING BEACON— A visual NAVAID operated at many airports. At civil airports, alternating white and green flashes indicate the location of the airport. At military airports, the beacons flash alternately white and green, but are differentiated from civil beacons by dualpeaked (two quick) white flashes between the green flashes. (See Special VFR Operations, Instrument Flight Rules) (Refer to AIM, Rotating Beacons)

ICAO-AERODROME BEACON—Aeronautical beacon used to indicate the location of an aerodrome.

AIRPORT SURFACE DETECTION EQUIPMENT/ASDE— Radar equipment specifically designed to detect all principal features on the surface of an airport, including aircraft and vehicular traffic, and to present the entire image on a radar indicator console in the control tower. Used to augment visual observation by tower personnel of aircraft and/or vehicular movements on runways and taxiways.

AIRPORT SURVEILLANCE RADAR/ASR— Approach control radar used to detect and display an aircraft's position in the terminal area. ASR provides range and azimuth information but does not provide elevation data. Coverage of the ASR can extend up to 60 miles.

AIRPORT TRAFFIC AREA— Unless otherwise specifically designated in FAR Part 93, that airspace within a horizontal radius of 5 statute miles from the geographical center of any airport at which a control tower is operating, extending from the surface up to, but not including, an altitude of 3,000 feet above the elevation of an airport. Unless otherwise authorized or required by ATC, no person may operate an aircraft within an airport traffic area except for the purpose of landing at or taking off from an airport within that area. ATC authorizations may be given as individual approval of specific operations or may be contained in written agreements between airport users and the tower concerned. (Refer to FAR, Parts 1 and 91).

AIRPORT TRAFFIC CONTROL SERVICE— A service provided by a control tower for aircraft operating on the movement area and in the vicinity of an airport. (See Movement Area, Tower)

ICAO-AERODROME CONTROL SERVICE—Air traffic control service for aerodrome traffic.

AIR ROUTE SURVEILLANCE RADAR/ARSR— Air route traffic control center (ARTCC) radar used primarily to detect and display an aircraft's position while en route between terminal areas. The ARSR enables controllers to provide radar air traffic control service when aircraft are within the ARSR coverage. In some instances, ARSR may enable an ARTCC to provide terminal radar services similar to but usually more limited than those provided by a radar approach control.

AIR ROUTE TRAFFIC CONTROL CENTER/ARTCC— A facility established to provide air traffic control service to aircraft operating on IFR flight plans within controlled airspace and principally during the en route phase of flight. When equipment capabilities and controller workload permit, certain advisory/assistance services may be provided to VFR aircraft. (See NAS Stage A, En Route Air Traffic Control Service) (Refer to AIM)

AIRSPEED— The speed of an aircraft relative to its surrounding air mass. The unqualified term "airspeed' means one of the following:

1. Indicated Airspeed—The speed shown on the aircraft airspeed indicator. This is the speed used in pilot/controller communications under the general term "airspeed." (Refer to FAR Part 1)
2. True Airspeed—The airspeed of an aircraft relative to undisturbed air. Used primarily in flight planning and en route portion of flight. When used in pilot/controller communications, it is referred to as "true airspeed" and not shortened to "airspeed."

AIRSTART— The starting of an aircraft engine while the aircraft is airborne, preceded by engine shutdown during training flights or by actual engine failure.

AIR TAXI— Used to describe a helicopter/VTOL aircraft movement conducted above the surface but normally not above 100 feet AGL. The aircraft may proceed either via hover taxi or flight at speeds more than 20 knots. The pilot is solely responsible for selecting a safe airspeed/altitude for the operation being conducted. (See Hover Taxi) (Refer to AIM)

AIR TRAFFIC— Aircraft operating in the air or on an airport surface, exclusive of loading ramps and parking areas.

ICAO—AIR TRAFFIC—All aircraft in flight or operating on the maneuvering area of an aerodrome.

AIR TRAFFIC CLEARANCE/ATC CLEARANCE— An authorization by air traffic control, for the purpose of preventing collision between known aircraft, for an aircraft to proceed under specified traffic conditions within controlled airspace. (See ATC Instructions)

ICAO—AIR TRAFFIC CONTROL CLEARANCE—Authorization for an aircraft to proceed under conditions specified by an air traffic control unit.

AIR TRAFFIC CONTROL/ATC— A service operated by appropriate authority to promote the safe, orderly and expeditious flow of air traffic.

ICAO—AIR TRAFFIC CONTROL SERVICE—A service provided for the purpose of:

1. Preventing collisions:
    a. Between aircraft, and
    b. On the maneuvering area between aircraft and obstructions, and
2. Expediting and maintaining an orderly flow of air traffic.

AIR TRAFFIC CONTROL COMMAND CENTER/ATCCC— An Air Traffic Operations Service facility consisting of four operational units.

1. Central Flow Control Function/CFCF—Responsible for coordination and approval of all major intercenter flow control restrictions on a system basis in order to obtain maximum utilization of the airspace. (See Fuel Advisory Departure, Quota Flow Control)
2. Central Altitude Reservation Function/CARF—Responsible for coordinating, planning, and approving special user requirements under the Altitude Reservation (ALTRV) concept. (See Altitude Reservation)
3. Airport Reservation Office/ARO—Responsible for approving IFR flights at designated high density traffic airports (John F. Kennedy, LaGuardia, O'Hare, and Washington National) during specified hours. (Refer to FAR Part 93 and Airport/Facility Directory)
4. ATC Contingency Command Post—A facility which enables the FAA to manage the ATC system when significant portions of the system's capabilities have been lost or are threatened.

AIR TRAFFIC CONTROL SERVICE— (See Air Traffic Control)

AIR TRAFFIC CONTROL SPECIALIST/CONTROLLER— A person authorized to provide air traffic control service. (See Air Traffic Control, Flight Service Station)

ICAO—CONTROLLER—A person authorized to provide air traffic control services.

AIRWAY BEACON— Used to mark airway segments in remote mountain areas. The light flashes Morse Code to identify the beacon site. (Refer to AIM)

AIRWAY/FEDERAL AIRWAY— A control area or portion thereof established in the form of a corridor, the centerline of which is defined by radio navigational aids. (Refer to FAR Part 71, AIM)

ICAO-AIRWAY—A control area or portion thereof established in the form of corridor equipped with radio navigational aids.

ALERT AREA— (See Special Use Airspace)

ALERT NOTICE/ALNOT— A message sent by a flight service station (FSS) or an air route traffic control center (ARTCC) that requests an extensive communication search for overdue, unreported, or missing aircraft.

ALPHANUMERIC DISPLAY/DATA BLOCK— Letters and numerals used to show identification, altitude, beacon code, and other information concerning a target on a radar display. (See Automated Radar Terminal Systems, NAS Stage A)

ALTERNATE AIRPORT— An airport at which an aircraft may land if a landing at the intended airport becomes inadvisable.

ICAO-ALTERNATE AERODROME—An aerodrome specified in the flight plan to which a flight may proceed when it becomes inadvisable to land at the aerodrome of intended landing.

ALTIMETER SETTING— The barometric pressure reading used to adjust a pressure altimeter for variations in existing atmospheric pressure or to the standard altimeter setting (29.92). (Refer to FAR Part 91, AIM)

ALTITUDE— The height of a level, point, or object measured in feet Above Ground Level (AGL) or from Mean Sea Level (MSL). (See Flight Level)

1. MSL Altitude—Altitude expressed in feet measured from mean sea level.
2. AGL Altitude—Altitude expressed in feet measured above ground level.
3. Indicated Altitude—The altitude as shown by an altimeter. On a pressure or barometric altimeter it is altitude as shown uncorrected for instrument error and uncompensated for variation from standard atmospheric conditions.

ICAO-ALTITUDE—The vertical distance of a level, a point or an object considered as a point, measured from mean sea level.

***ALTITUDE READOUT/AUTOMATIC ALTITUDE REPORT*—** An aircraft's altitude, transmitted via the Mode C transponder feature, that is visually displayed in 100-foot increments on a radar scope having readout capability. (See Automated Radar Terminal Systems, NAS Stage A, Alphanumeric Display) (Refer to AIM)

ALTITUDE RESERVATION/ALTRV— Airspace utilization under prescribed conditions normally employed for the mass movement of aircraft or other special user requirements which cannot otherwise be accomplished. ALTRVs are approved by the appropriate FAA facility. (See Air Traffic Control Command Center)

ALTITUDE RESTRICTION— An altitude or altitudes, stated in the order flown, which are to be maintained until reaching a specific point or time. Altitude restrictions may be issued by ATC due to traffic, terrain, or other airspace considerations.

***ALTITUDE RESTRICTIONS ARE CANCELED*—** Adherence to previously imposed altitude restrictions is no longer required during a climb or descent.

APPROACH CLEARANCE— Authorization by ATC for a pilot to conduct an instrument approach. The type of instrument approach for which a clearance and other pertinent information is provided in the approach clearance when required. (See Instrument Approach Procedure, Cleared for Approach) (Refer to AIM and FAR Part 91)

APPROACH CONTROL FACILITY— A terminal ATC facility that provides approach control service in a terminal area. (See Approach Control Service, Radar Approach Control Facility.

APPROACH CONTROL SERVICE— Air traffic control service provided by an approach control facility for arriving and departing VFR/IFR aircraft and, on occasion, en route aircraft. At some airports not served by an approach control facility, the ARTCC provides limited approach control service. (Refer to AIM)

ICAO—APPROACH CONTROL SERVICE—Air traffic service for arriving or departing controlled flights.

APPROACH GATE— The point on the final approach course which is 1 mile from the final approach fix on the side away from the airport or 5 miles from the landing threshold along the final approach course, whichever is farther from the landing threshold. This is an imaginary point used within ATC as a basis for final approach course interception for aircraft being vectored to the final approach course.

APPROACH LIGHT SYSTEM— (See Airport Lighting)

APPROACH SEQUENCE— The order in which aircraft are positioned while on approach or awaiting approach clearance. (See Landing Sequence)

ICAO—APPROACH SEQUENCE—The order in which two or more aircraft are cleared to approach to land at the aerodrome.

***APPROACH SPEED*—** The recommended speed contained in aircraft manuals used by pilots when making an approach to landing. This speed will vary for different segments of an approach as well as for aircraft weight and configuration.

APRON/RAMP— A defined area on an airport or heliport intended to accommodate aircraft for purposes of loading or unloading passengers or cargo, refueling, parking, or maintenance. With regard to seaplanes, a ramp is used for access to the apron from the water.

ICAO—APRON—A defined area, on a land aerodrome, intended to accommodate aircraft for purposes of loading or unloading passengers or cargo, refueling, parking or maintenance.

ARC— The track over the ground of an aircraft flying at a constant distance from a navigational aid by reference to distance measuring equipment (DME).

AREA NAVIGATION/RNAV— A method of navigation that permits aircraft operation on any desired course within the coverage of station-referenced navigation signals or within the limits of a self-contained system capability. The major types of equipment are:

1. VORTAC referenced or Course Line Computer (CLC) systems, which account for the greatest number of RNAV units in use. To function, the CLC must be within the service range of a VORTAC.
2. OMEGA/VLF, although two separate systems, can be considered as one operationally. A long-range navigation system based upon Very Low Frequency radio signals transmitted from a total of 17 stations worldwide.
3. Inertial (INS) systems, which are totally self-contained and require no information from external references. They provide aircraft position and navigation information in response to signals resulting from inertial effects on components within the system.
4. MLS Area Navigation (MLS/RNAV), which provides area navigation with reference to an MLS ground facility.

Random Area Navigation routes are direct routes, based on area navigation capability, between waypoints defined in terms of latitude/longitude coordinates, degree/distance fixes, or offsets from published or established routes/airways at a specified distance and direction.

ICAO—AREA NAVIGATION/RNAV—A method of navigation which permits aircraft operation on any desired flight path within the coverage of station-referenced navigation aids or within the limits of the capability of self-contained aids or a combination of these.

ARMY AVIATION FLIGHT INFORMATION BULLETIN/USAFIB— A bulletin that provides air operation data covering Army, National Guard, and Army Reserve aviation activities.

ARRESTING SYSTEM— A safety device consisting of two major components, namely, engaging or catching devices and energy absorption devices for the purpose of arresting both tailhook and/or nontailhook-equipped aircraft. It is used to prevent aircraft from overrunning runways when the aircraft cannot be stopped after landing or during aborted takeoff. Arresting systems have various names; e.g., arresting gear, hook device, wire barrier cable. (See Abort) (Refer to AIM)

ARRIVAL TIME— The time an aircraft touches down on arrival.

ARTCC— (See Air Route Traffic Control Center)

ASR APPROACH— (See Surveillance Approach)

ATC ADVISES— Used to prefix a message of noncontrol information when it is relayed to an aircraft by other than an air traffic controller. (See Advisory)

ATC ASSIGNED AIRSPACE/ATCAA— Airspace of defined vertical/lateral limits, assigned by ATC, for the purpose of providing air traffic segregation between the specified activities being conducted within the assigned airspace and other IFR air traffic. (See Military Operations Area, Alert Area)

ATC CLEARANCE— (See Air Traffic Clearance)

ATC CLEARS— Used to prefix an ATC clearance when it is relayed to an aircraft by other than an air traffic controller.

ATC INSTRUCTIONS— Directives issued by air traffic control for the purpose of requiring a pilot to take specific actions; e.g., "Turn left heading two five zero," "Go around," "Clear the runway." (Refer to FAR Part 91)

ATCRBS— (See Radar)

ATC REQUESTS— Used to prefix an ATC request when it is relayed to an aircraft by other than an air traffic controller.

AUTOMATED RADAR TERMINAL SYSTEMS/ARTS— The generic term for the ultimate in functional capability afforded by several automation systems. Each differs in functional capabilities and equipment. ARTS plus a suffix roman numeral denotes a specific system. A following letter indicates a major modification to that system. In general, an ARTS displays for the terminal controller aircraft identification, flight plan data, other flight associated information; e.g., altitude, speed, and aircraft position symbols in conjunction with his radar presentation. Normal radar co-exists with the alphanumeric display. In addition to enhancing visualization of the air traffic situation, ARTS facilitate intra/inter-facility transfer and coordination of flight information. These capabilities are enabled by specially designed computers and subsystems tailored to the radar and communications equipments and operational requirements of each automated facility. Modular design permits adoption of improvements in computer software and electronic technologies as they become available while retaining the characteristics unique to each system.

1. ARTS II—A programmable nontracking, computer- aided display subsystem capable of modular expansion. ARTS II systems provide a level of automated air traffic control capability at terminals having low to medium activity. Flight identification and altitude may be associated with the display of secondary radar targets. Also, flight plan information may be exchanged between the terminal and ARTCC.

2. ARTS III—The Beacon Tracking Level (BTL) of the modular programmable automated radar terminal system in use at medium to high activity terminals. ARTS III detects, tracks, and predicts secondary radar-derived aircraft targets. These are displayed by means of computer-generated symbols and alphanumeric characters depicting flight identification, aircraft altitude, ground speed, and flight plan data. Although it does not track primary targets, they are displayed coincident with the secondary radar as well as the symbols and alphanumerics. The system has the capability of communicating with ARTCC's and other ARTS III facilities.

3. ARTS IIIA—The Radar Tracking and Beacon Tracking Level (RT&BTL) of the modular, programmable automated radar terminal system. ARTS IIIA detects, tracks, and predicts primary as well as secondary radar-derived aircraft targets. This more sophisticated computer-driven system upgrades the existing ARTS III system by providing improved tracking, continuous data recording, and fail-soft capabilities.

AUTOMATIC ALTITUDE REPORTING— That function of a transponder which responds to Mode C interrogations by transmitting the aircraft's altitude in 100-foot increments.

AUTOMATIC CARRIER LANDING SYSTEM/ACLS— U.S. Navy final approach equipment consisting of precision tracking radar coupled to a computer data link to provide continuous information to the aircraft, monitoring capability to the pilot, and a backup approach system.

AUTOMATIC DIRECTION FINDER/ADF— An aircraft radio navigation system which senses and indicates the direction to a L/MF nondirectional radio beacon (NDB) ground transmitter. Direction is indicated to the pilot as a magnetic bearing or as a relative bearing to the longitudinal axis of the aircraft depending on the type of indicator installed in the aircraft. In certain applications, such as military, ADF operations may be based on airborne and ground transmitters in the VHF/UHF frequency spectrum. (See Bearing, Nondirectional Beacon)

AUTOMATIC TERMINAL INFORMATION SERVICE/ATIS— The continuous broadcast of recorded noncontrol information in selected terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information; e.g.,"Los Angeles information Alfa. One three zero zero Coordinated Universal Time. Weather, measured ceiling two thousand overcast, visibility three, haze, smoke, temperature seven one, dew point five seven, wind two five zero at five, altimeter two niner niner six. I-L-S Runway Two Five Left approach in use, Runway Two Five Right closed, advise you have Alfa." (Refer to AIM)

ICAO—AUTOMATIC TERMINAL INFORMATION SERVICE—The provision of current, routine information to arriving and departing aircraft by means of continuous and repetitive broadcasts throughout the day or a specified portion of the day.

AUTOROTATION— A rotorcraft flight condition in which the lifting rotor is driven entirely by action of the air when the rotorcraft is in motion.

1. Autorotative Landing/Touchdown Autorotation—Used by a pilot to indicate that he will be landing without applying power to the rotor.

2. Low Level Autorotation—Commences at an altitude well below the traffic pattern, usually below 100 feet AGL and is used primarily for tactical military training.

3. 180 degrees Autorotation—Initiated from a downwind heading and is commenced well inside the normal traffic pattern. "Go around" may not be possible during the latter part of this maneuver.

AVIATION WEATHER SERVICE— A service provided by the National Weather Service (NWS) and FAA which collects and disseminates pertinent weather information for pilots, aircraft operators, and ATC. Available aviation weather reports and forecasts are displayed at each NWS office and FAA FSS. (See En Route Flight Advisory Service, Transcribed Weather Broadcast, Weather Advisory, Pilots Automatic Telephone Weather Answering Service) (Refer to AIM)

AZIMUTH, MLS—A magnetic bearing extending from an MLS navigation facility. Note: azimuth bearings are described as magnetic and are referred to as "azimuth" in radio telephone communications.

BASE LEG— (See Traffic Pattern)

BEACON— (See Radar, Nondirectional Beacon, Marker Beacon, Airport Rotating Beacon, Aeronautical Beacon, Airway Beacon))

BEARING— The horizontal direction to or from any point, usually measured clockwise from true north, magnetic north, or some other reference point through 360 degrees. (See Nondirectional Beacon)

BELOW MINIMUMS— Weather conditions below the minimums prescribed by regulation for the particular action involved; e.g., landing minimums, takeoff minimums.

BLAST FENCE— A barrier that is used to divert or dissipate jet or propeller blast.

BLIND SPEED— The rate of departure or closing of a target relative to the radar antenna at which cancellation of the primary radar target by moving target indicator (MTI) circuits in the radar equipment causes a reduction or complete loss of signal.

ICAO—BLIND VELOCITY—The radial velocity of a moving target such that the target is not seen on primary radars fitted with certain forms of fixed echo suppression.

BLIND SPOT/BLIND ZONE— An area from which radio transmissions and/or radar echoes cannot be received. The term is also used to describe portions of the airport not visible from the control tower.

BOUNDARY LIGHTS— (See Airport Lighting)

BRAKING ACTION (GOOD, FAIR, POOR, OR NIL)— A report of conditions on the airport movement area providing a pilot with a degree/quality of braking that he might expect. Braking action is reported in terms of good, fair, poor, or nil. (See Runway Condition Reading)

BRAKING ACTION ADVISORIES— When tower controllers have received runway braking action reports which include the terms "poor" or "nil," or whenever weather conditions are conducive to deteriorating or rapidly changing runway braking conditions, the tower will include on the ATIS broadcast the statement, "BRAKING ACTION ADVISORIES ARE IN EFFECT." During the time Braking Action Advisories are in effect, ATC will issue the latest braking action report for the runway in use to each arriving and departing aircraft. Pilots should be prepared for deteriorating braking conditions and should request current runway condition information if not volunteered by controllers. Pilots should also be prepared to provide a descriptive runway condition report to controllers after landing.

BROADCAST— Transmission of information for which an acknowledgement is not expected.

*ICAO—BROADCAST—*A transmission of information relating to air navigation that is not addressed to a specific station or stations.

CALL UP— Initial voice contact between a facility and an aircraft, using the identification of the unit being called and the unit initiating the call. (Refer to AIM)

CARDINAL ALTITUDES OR FLIGHT LEVELS— "Odd" or "Even" thousand-foot altitudes or flight levels; e.g., 5,000, 6,000, 7,000, FL 250, FL 260, FL 270. (See Altitude, Flight Levels)

CEILING— The heights above the earth's surface of the lowest layer of clouds or obscuring phenomena that is reported as "broken," "overcast," or "obscuration," and not classified as "thin" or "partial".

*ICAO—CEILING—*The height above the ground or water of the base of the lowest layer of cloud below 6,000 meters (20,000 feet) covering more than half the sky.

CELESTIAL NAVIGATION— The determination of geographical position by reference to celestial bodies. Normally used in aviation as a secondary means of position determination.

CENTER— (See Air Route Traffic Control Center)

CENTER'S AREA— The specified airspace within which an air route traffic control center (ARTCC) provides air traffic control and advisory service. (See Air Route Traffic Control Center) (Refer to AIM)

CENTER WEATHER ADVISORY/CWA— An unscheduled weather advisory issued by Center Weather Service Unit meteorologists for ATC use to alert pilots of existing or anticipated adverse weather conditions within the next 2 hours. A CWA may modify or redefine a SIGMET.

CHAFF— Thin, narrow metallic reflectors of various lengths and frequency responses, used to reflect radar energy. These reflectors when dropped from aircraft and allowed to drift downward result in large targets on the radar display.

CHARTED VISUAL FLIGHT PROCEDURE (CVFP) APPROACH— An approach wherein a radar-controlled aircraft on an IFR flight plan, operating in VFR conditions and having an ATC authorization, may proceed to the airport of intended landing via visual landmarks and altitudes depicted on a charted visual flight procedure.

CHASE/CHASE AIRCRAFT— An aircraft flown in proximity to another aircraft normally to observe its performance during training or testing.

CIRCLE-TO-LAND MANEUVER/CIRCLING MANEUVER— A maneuver initiated by the pilot to align the aircraft with a runway for landing when a straight-in landing from an instrument approach is not possible or is not desirable. This maneuver is made only after ATC authorization has been obtained and the pilot has established required visual reference to the airport (See Circle to Runway, Landing Minimums) (Refer to AIM)

CIRCLE TO RUNWAY (RUNWAY NUMBERED)— Used by ATC to inform the pilot that he must circle to land because the runway in use is other than the runway aligned with the instrument approach procedure. When the direction of the circling maneuver in relation to the airport/runway is required, the controller will state the direction (eight cardinal compass points) and specify a left or right downwind or base leg as appropriate; e.g., "Cleared VOR Runway Three Six Approach circle to Runway Two Two," or "Circle northwest of the airport for a right downwind to Runway Two Two." (See Circle-to-Land Maneuver, Landing Minimums) (Refer to AIM)

CIRCLING APPROACH— (See Circle-to-Land Maneuver)

CIRCLING MINIMA— (See Landing Minimums)

CLEAR-AIR TURBULENCE/CAT— Turbulence encountered in air where no clouds are present. This term is commonly applied to high-level turbulence associated with wind shear. CAT is often encountered in the vicinity of the jet stream. (See Wind Shear, Jet Stream)

CLEARANCE— (See Air Traffic Clearance)

CLEARANCE LIMIT— The fix, point, or location to which an aircraft is cleared when issued an air traffic clearance.

*ICAO—CLEARANCE LIMIT—*The point of which an aircraft is granted an air traffic control clearance.

CLEARANCE VOID IF NOT OFF BY (TIME)— Used by ATC to advise an aircraft that the departure clearance is automatically cancelled if takeoff is not made prior to a specified time. The pilot must obtain a new clearance or cancel his IFR flight plan if not off by the specified time.

ICAO—CLEARANCE VOID TIME— A time specified by an air traffic control unit at which a clearance ceases to be valid unless the aircraft concerned has already taken action to comply therewith.

CLEARED AS FILED— Means the aircraft is cleared to proceed in accordance with the route of flight filed in the flight plan. This clearance does not include the altitude, SID, or SID Transition. (See Request Full Route Clearance) (Refer to AIM)

CLEARED FOR (Type Of) APPROACH— ATC authorization for an aircraft to execute a specific instrument approach procedure to an airport; e.g., "Cleared for ILS Runway Three Six Approach." (See Instrument Approach Procedure, Approach Clearance) (Refer to AIM, FAR Part 91)

CLEARED FOR APPROACH— ATC authorization for an aircraft to execute any standard or special instrument approach procedure for that airport. Normally, an aircraft will be cleared for a specific instrument approach procedure. (See Instrument Approach Procedure, Cleared for (Type of) Approach) (Refer to AIM, FAR Part 91)

CLEARED FOR TAKEOFF— ATC authorization for an aircraft to depart. It is predicated on known traffic and known physical airport conditions.

CLEARED FOR THE OPTION— ATC authorization for an aircraft to make a touch-and-go, low approach, missed approach, stop and go, or full stop landing at the discretion of the pilot. It is normally used in training so that an instructor can evaluate a student's performance under changing situations. (See Option Approach) (Refer to AIM)

CLEARED THROUGH— ATC authorization for an aircraft to make intermediate stops at specified airports without refiling a flight plan while en route to the clearance limit.

CLEARED TO LAND— ATC authorization for an aircraft to land. It is predicated on known traffic and known physical airport conditions.

CLEARWAY— An area beyond the takeoff runway under the control of airport authorities within which terrain or fixed obstacles may not extend above specified limits. These areas may be required for certain turbine-powered operations and the size and upward slope of the clearway will differ depending on when the aircraft was certificated. (Refer to FAR Part 1)

CLIMBOUT— That portion of flight operation between takeoff and the initial cruising altitude.

CLIMB TO VFR— ATC authorization for an aircraft to climb to VFR conditions within a control zone when the only weather limitation is restricted visibility. The aircraft must remain clear of clouds while climbing to VFR. (See Special VFR) (Refer to AIM)

CLOSED RUNWAY— A runway that is unusable for aircraft operations. Only the airport management/military operations office can close a runway.

CLOSED TRAFFIC— Successive operations involving takeoffs and landings or low approaches where the aircraft does not exit the traffic pattern.

CLUTTER— In radar operations, clutter refers to the reception and visual display of radar returns caused by precipitation, chaff, terrain, numerous aircraft targets, or other phenomena. Such returns may limit or preclude ATC from providing services based on radar. (See Ground Clutter, Chaff, Precipitation, Target)

*ICAO—Radar Clutter—*The visual indication on a radar display of unwanted signals.

COASTAL FIX— A navigation aid or intersection where an aircraft transitions between the domestic route structure and the oceanic route structure.

CODES/TRANSPONDER CODES— The number assigned to a particular multiple pulse reply signal transmitted by a transponder. (See Discrete Code)

COMBINED CENTER-RAPCON/CERAP— An air traffic facility which combines the functions of an ARTCC and a radar approach control facility. (See Air Route Traffic Control Center/ARTCC, Radar Approach Control Facility)

COMMON ROUTE/COMMON PORTION— That segment of a North American Route between the inland navigation facility and the coastal fix.

COMMON TRAFFIC ADVISORY FREQUENCY/CTAF— A frequency designed for the purpose of carrying out airport advisory practices while operating to or from an uncontrolled airport. The CTAF may be a UNICOM, Multicom, FSS, or tower frequency and is identified in appropriate aeronautical publications. (Refer to AC—90-42C)

COMPASS LOCATOR— A low power, low or medium frequency (L/MF) radio beacon installed at the site of the outer or middle marker of an instrument landing system (ILS). It can be used for navigation at distances of approximately 15 miles or as authorized in the approach procedure.

1. Outer Compass Locator/LOM—A compass locator installed at the site of the outer marker of an instrument landing system. (See Outer Marker)
2. Middle Compass Locator/LMM—A compass locator installed at the site of the middle marker of an instrument landing system. (See Middle Marker)

*ICAO—LOCATOR—*An LM/MF NDB used as an aid to final approach.

COMPASS ROSE— A circle, graduated in degrees, printed on some charts or marked on the ground at an airport. It is used as a reference to either true or magnetic direction.

COMPOSITE FLIGHT PLAN— A flight plan which specifies VFR operation for one portion of flight and IFR for another portion. It is used primarily in military operations. (Refer to AIM)

COMPOSITE ROUTE SYSTEM— An organized oceanic route structure, incorporating reduced lateral spacing between routes, in which composite separation is authorized.

COMPOSITE SEPARATION— A method of separating aircraft in a composite route system where, by management of route and altitude assignments, a combination of half the lateral minimum specified for the area concerned and half the vertical minimum is applied.

COMPULSORY REPORTING POINTS— Reporting points which must be reported to ATC. They are designated on aeronautical charts by solid triangles or filed in a flight plan as fixes selected to define direct routes. These points are geographical locations which are defined by navigation aids/fixes. Pilots should discontinue position reporting over compulsory reporting points when informed by ATC that their aircraft is in "radar contact."

CONFLICT ALERT— A function of certain air traffic control automated systems designed to alert radar controllers to existing or pending situations recognized by the program parameters that require his immediate attention/action.

CONFLICT RESOLUTION— The resolution of potential conflictions between IFR aircraft and VFR aircraft that are radar identified and in communication with ATC by ensuring that radar targets do not touch. Pertinent traffic advisories shall be issued when this procedure is applied. Note: This separation procedure will not be provided utilizing fully digitized radar systems. (See Controlled Airspace—Airport Radar Service Area / ARSA, Outer Area)

CONSOLAN— A low frequency, long-distance NAVAID used principally for transoceanic navigations.

CONTACT—

1. Establish communication with (followed by the name of the facility and, if appropriate, the frequency to be used).
2. A flight condition wherein the pilot ascertains the attitude of his aircraft and navigates by visual reference to the surface. (See Contact Approach, Radar Contact)

CONTACT APPROACH— An approach wherein an aircraft on an IFR flight plan, having an air traffic control authorization, operating clear of clouds with at least 1 mile flight visibility and a reasonable expectation of continuing to the destination airport in those conditions, may deviate from the instrument approach procedure and proceed to the destination airport by visual reference to the surface. This approach will only be authorized when requested by the pilot and the reported ground visibility at the destination airport is at least 1 statute mile. (Refer to AIM)

CONTERMINOUS U.S.— The 48 adjoining States and the District of Columbia.

CONTINENTAL CONTROL AREA— (See Controlled Airspace)

CONTINENTAL UNITED STATES— The 49 States located on the continent of North America and the District of Columbia.

CONTROL AREA— (See Controlled Airspace)

CONTROLLED AIRSPACE— Airspace designated as a control zone, airport radar service area, terminal control area, transition area, control area, continental control area, and positive control area within which some or all aircraft may be subject to air traffic control. (Refer to AIM, FAR Part 71)

*ICAO—CONTROLLED AIRSPACE—*Airspace of defined dimensions within which air traffic control service is provided to controlled flights.

Types of U.S. Controlled Airspace:

1. Control Zone—Controlled airspace which extends upward from the surface of the earth and terminates at the base of the continental control area. Control zones that do not underlie the continental control area have no upper limit. A control zone may include one or more airports and is normally a circular area with a radius of 5 statute miles and any extensions necessary to include instrument approach and departure paths.

*ICAO—Control Zone—*A controlled airspace extending upwards from the surface of the earth to a specified upper limit.

2. Airport Radar Service Area / ARSA—Regulatory airspace surrounding designated airports wherein ATC provides radar vectoring and sequencing on a full-time basis for all IFR and VFR aircraft. The service provided in an ARSA is called ARSA service which includes: IFR/IFR—standard IFR separation; IFR/VFR—traffic advisories and conflict resolution; and VFR/VFR—traffic advisories and, as appropriate, safety alerts. The AIM contains an explanation of ARSA. The ARSA's are depicted on VFR aeronautical charts. (See Conflict Resolution, Outer Area) (Refer to AIM, Airport/Facility Directory, FAR Part 91)
3. Terminal Control Area/TCA—Controlled airspace extending upward from the surface or higher to specified altitudes, within which all aircraft are subject to operating rules and pilot and equipment requirements specified in FAR Part 91. TCA's are depicted on Sectional, World Aeronautical, En Route Low Altitude, DOD FLIP, and TCA charts. (Refer to FAR Part 91, AIM)

*ICAO—Terminal Control Area—*A control area normally established at the confluence of ATS routes in the vicinity of one or more major aerodromes.

4. Transition Area—Controlled airspace extending upward from 700 feet or more above the surface of the earth when designated in conjunction with an airport for which an approved instrument approach procedure has been prescribed; or from 1,200 feet or more above the surface of the earth when designated in conjunction with airway route structures or segments. Unless otherwise specified, transition areas terminate at the base of the overlying controlled airspace. Transition areas are designed to contain IFR operations in controlled airspace during portions of the terminal operation and while transiting between the terminal and en route environment.
5. Control Area—Airspace designated as Colored Federal airways, VOR Federal airways, control areas associated with jet routes outside the continental control area (FAR 71.161), additional control areas (FAR 71.163), control area extensions (FAR 71.165), and area low routes. Control areas do not include the continental control area, but unless otherwise designated, they do include the

airspace between a segment of a main VOR Federal airway and its associated alternate segments with the vertical extent of the area corresponding to the vertical extent of the related segment of the main airway. The vertical extent of the various categories of airspace contained in control areas is defined in FAR Part 71.

ICAO—Control Area—A controlled airspace extending upward from a specified limit above the earth.

6. Continental Control Area—The airspace of the 48 contiguous States, the District of Columbia and Alaska, excluding the Alaska peninsula west of Long. 160° 00' 00"W, at and above 14,500 feet MSL, but does not include:
   a. The airspace less than 1,500 feet above the surface of the earth; or
   b. Prohibited and restricted areas, other than the restricted areas listed in FAR Part 71.
7. Positive Control Area/PCA—Airspace designated in FAR, Part 71 within which there is positive control of aircraft. Flight in PCA is normally conducted under instrument flight rules. PCA is designated throughout most of the conterminous United States and its vertical extent is from 18,000 feet MSL to and including flight level 600. In Alaska PCA does not include the airspace less than 1,500 feet above the surface of the earth nor the airspace over the Alaska Peninsula west of longitude 160 degrees West. Rules for operating in PCA are found in FARs 91.97 and 91.24.

CONTROLLER— (See Air Traffic Control Specialist)

CONTROL SECTOR— An airspace area of defined horizontal and vertical dimensions for which a controller or group of controllers has air traffic control responsibility, normally within an air route traffic control center or an approach control facility. Sectors are established based on predominant traffic flows, altitude strata, and controller workload. Pilot-communications during operations within a sector are normally maintained on discrete frequencies assigned to the sector. (See Discrete Frequency)

CONTROL SLASH— A radar beacon slash representing the actual position of the associated aircraft. Normally, the control slash is the one closest to the interrogating radar beacon site. When ARTCC radar is operating in narrowband (digitized) mode, the control slash is converted to a target symbol.

CONTROL ZONE— (See Controlled Airspace)

CONVECTIVE SIGMET **/WST/CONVECTIVE SIGNIFICANT METEOROLOGICAL INFORMATION—** A weather advisory concerning convective weather significant to the safety of all aircraft. Convective SIGMET's are issued for tornadoes, lines of thunderstorms, embedded thunderstorms of any intensity level, areas of thunderstorms greater than or equal to VIP level 4 with an areal coverage of 4/10 (40%) or more, and hail 3/4 inch or greater. (See SIGMET, AIRMET) (Refer to AIM)

COORDINATES— The intersection of lines of reference, usually expressed in degrees/minutes/seconds of latitude and longitude, used to determine position or location.

COORDINATION FIX— The fix in relation to which facilities will handoff, transfer control of an aircraft, or coordinate flight progress data. For terminal facilities, it may also serve as a clearance for arriving aircraft.

CORRECTION— An error has been made in the transmission and the correct version follows.

COURSE—

1. The intended direction of flight in the horizontal plane measured in degrees from north.
2. The ILS localizer signal pattern usually specified as the front course or the back course.
3. The intended track along a straight, curved, or segmented MLS path.

   (See Bearing, Radial, Instrument Landing System, Microwave Landing System)

CRITICAL ENGINE— The engine which, upon failure, would most adversely affect the performance or handling qualities of an aircraft.

CROSS (FIX) AT (ALTITUDE)— Used by ATC when a specific altitude restriction at a specified fix is required.

CROSS (FIX) AT OR ABOVE (ALTITUDE)— Used by ATC when an altitude restriction at a specified fix is required. It does not prohibit the aircraft from crossing the fix at a higher altitude than specified; however, the higher altitude may not be one that will violate a succeeding altitude restriction or altitude assignment. (See Altitude Assignment, Altitude Restriction.) (Refer to AIM)

CROSS (FIX) AT OR BELOW (ALTITUDE)— Used by ATC when a maximum crossing altitude at a specific fix is required. It does not prohibit the aircraft from crossing the fix at a lower altitude; however, it must be at or above the minimum IFR altitude. (See Minimum IFR Altitude, Altitude Restriction) (Refer to FAR Part 91)

CROSSWIND—

1. When used concerning the traffic pattern, the word means "crosswind leg." (See Traffic Pattern)
2. When used concerning wind conditions, the word means a wind not parallel to the runway or the path of an aircraft. (See Crosswind Component)

CROSSWIND COMPONENT— The wind component measured in knots at 90 degrees to the longitudinal axis of the runway.

CRUISE— Used in an ATC clearance to authorize a pilot to conduct flight at any altitude from the minimum IFR altitude up to and including the altitude specified in the clearance. The pilot may level off at any intermediate altitude within this block of airspace. Climb/descent within the block is to be made at the discretion of the pilot. However, once the pilot starts descent and verbally reports leaving an altitude in the block, he may not return to that altitude without additional ATC clearance. Further, it is approval for the pilot to proceed to and make an approach at destination airport and can be used in conjunction with:

1. An airport clearance limit at locations with a standard/special instrument approach procedure. The FAR's require that if an instrument letdown to an airport is necessary, the pilot shall make the letdown in accordance with a standard/special instrument approach procedure for that airport, or

2. An airport clearance limit at locations that are within/below/outside controlled airspace and without a standard/special instrument approach procedure. Such a clearance is NOT AUTHORIZATION for the pilot to descend under IFR conditions below the applicable minimum IFR altitude nor does it imply that ATC is exercising control over aircraft in uncontrolled airspace; however, it provides a means for the aircraft to proceed to destination airport, descend, and land in accordance with applicable FAR's governing VFR flight operations. Also, this provides search and rescue protection until such time as the IFR flight plan is closed. (See Instrument Approach Procedure)

CRUISING ALTITUDE/LEVEL— An altitude or flight level maintained during en route level flight. This is a constant altitude and should not be confused with a cruise clearance. (See Altitude)

*ICAO—CRUISING LEVEL—*A level maintained during a significant portion of a flight.

DECISION HEIGHT/DH— With respect to the operation of aircraft, means the height at which a decision must be made during an ILS, MLS, or PAR instrument approach to either continue the approach or to execute a missed approach.

*ICAO—DECISION HEIGHT—*A specified height at which a missed approach must be initiated if the required visual reference to continue the approach to land has not been established.

DECODER— The device used to decipher signals received from ATCRBS transponders to effect their display as select codes. (See Codes, Radar)

DEFENSE VISUAL FLIGHT RULES/DVFR— Rules applicable to flights within an ADIZ conducted under the visual flight rules in FAR, Part 91. (See Air Defense Identification Zone) (Refer to FAR, Part 99)

DELAY INDEFINITE (REASON IF KNOWN) EXPECT FURTHER CLEARANCE (TIME)— Used by ATC to inform a pilot when an accurate estimate of the delay time and the reason for the delay cannot immediately be determined; e.g., a disabled aircraft on the runway, terminal or center area saturation, weather below landing minimums, etc. (See Expect Further Clearance)

DEPARTURE CONTROL— A function of an approach control facility providing air traffic control service for departing IFR and, under certain conditions, VFR aircraft. (See Approach Control) (Refer to AIM)

DEPARTURE TIME— The time an aircraft becomes airborne.

DEVIATIONS—

1. A departure from a current clearance, such as an off course maneuver to avoid weather or turbulence.

2. Where specifically authorized in the FAR's and requested by the pilot, ATC may permit pilots to deviate from certain regulations. (Refer to AIM)

DF APPROACH PROCEDURE— Used under emergency conditions where another instrument approach procedure cannot be executed. DF guidance for an instrument approach is given by ATC facilities with DF capability. (See DF Guidance, Direction Finder) (Refer to AIM)

DF FIX— The geographical location of an aircraft obtained by one or more direction finders. (See Direction Finder)

DF GUIDANCE/DF STEER— Headings provided to aircraft by facilities equipped with direction finding equipment. These headings, if followed, will lead the aircraft to a predetermined point such as the DF station or an airport. DF guidance is given to aircraft in distress or to other aircraft which request the service. Practice DF guidance is provided when workload permits. (See Direction Finder, DF Fix) (Refer to AIM)

DIRECT— Straight line flight between two navigational aids, fixes, points, or any combination thereof. When used by pilots in describing off-airway routes, points defining direct route segments become compulsory reporting points unless the aircraft is under radar contact.

DIRECT ALTITUDE AND IDENTITY READOUT/ DAIR— The DAIR System is a modification to the AN/TPX-42 Interrogator System. The Navy has two adaptations of the DAIR System— Carrier Air Traffic Control Direct Altitude and Identification Readout System for Aircraft Carriers and Radar Air Traffic Control Facility Direct Altitude and Identity Readout System for land-based terminal operations. The DAIR detects, tracks, and predicts secondary radar aircraft targets. Targets are displayed by means of computer-generated symbols and alphanumeric characters depicting flight identification, altitude, ground speed, and flight plan data. The DAIR System is capable of interfacing with ARTCC's.

DIRECTION FINDER/DF/UDF/VDF/UVDF— A radio receiver equipped with a directional sensing antenna used to take bearings on a radio transmitter. Specialized radio direction finders are used in aircraft as air navigation aids. Others are ground-based, primarily to obtain a "fix" on a pilot requesting orientation assistance or to locate downed aircraft. A location "fix" is established by the intersection of two or more bearing lines plotted on a navigational chart using either two separately located Direction Finders to obtain a fix on an aircraft or by a pilot plotting the bearing indications of his DF on two separately located ground-based transmitters, both of which can be identified on his chart. UDF's receive signals in the ultra high frequency radio broadcast band; VDF's in the very high frequency band; and UVDF's in both bands. ATC provides DF service at those air traffic control towers and flight service stations listed in the Airport/Facility Directory and the DOD FLIP IFR En Route Supplement. (See DF Guidance, DF Fix)

DISCRETE CODE/DISCRETE BEACON CODE— As used in the Air Traffic Control Radar Beacon System (ATCRBS), any one of the 4096 selectable Mode 3/A aircraft transponder codes except those ending in zero zero; e.g., discrete codes: 0010, 1201, 2317, 7777; non-discrete codes: 0100, 1200, 7700. Non-discrete codes are normally reserved for radar facilities that are not equipped with discrete decoding capability and for other purposes such as emergencies (7700), VFR aircraft (1200), etc. (See Radar) (Refer to AIM)

DISCRETE FREQUENCY— A separate radio frequency for use in direct pilot-controller communications in air traffic control which reduces frequency congestion by controlling the number of aircraft operating on a particular frequency at one time. Discrete frequencies are normally designated for each control sector in en route/terminal ATC facilities. Discrete frequencies are listed in the Airport/Facility Directory and the DOD FLIP IFR En Route Supplement. (See Control Sector)

DISPLACED THRESHOLD— A threshold that is located at a point on the runway other than the designated beginning of the runway. (See Threshold) (Refer to AIM)

DISTANCE MEASURING EQUIPMENT/DME— Equipment (airborne and ground) used to measure, in nautical miles, the slant range distance of an aircraft from the DME navigational aid. (See TACAN, VORTAC, Microwave Landing System)

DISTRESS— A condition of being threatened by serious and/or imminent, danger, and of requiring immediate assistance.

DME FIX— A geographical position determined by reference to a navigational aid which provides distance and azimuth information. It is defined by a specific distance in nautical miles and a radial, azimuth, or course (i.e., localizer) in degrees magnetic from that aid. (See Distance Measuring Equipment/DME, Fix, Microwave Landing System)

DME SEPARATION— Spacing of aircraft in terms of distances (nautical miles) determined by reference to distance measuring equipment (DME). (See Distance Measuring Equipment)

DOD FLIP— Department of Defense Flight Information Publications used for flight planning, en route, and terminal operations. FLIP is produced by the Defense Mapping Agency for world-wide use. United States Government Flight Information Publications (en route charts and instrument approach procedure charts) are incorporated in DOD FLIP for use in the National Airspace System (NAS).

DOWNWIND LEG— (See Traffic Pattern)

DRAG CHUTE— A parachute device installed on certain aircraft which is deployed on landing roll to assist in deceleration of the aircraft.

EMERGENCY— A DISTRESS or URGENCY condition.

EMERGENCY LOCATOR TRANSMITTER/ELT— A radio transmitter attached to the aircraft structure which operates from its own power source on 121.5 MHz and 243.0 MHz. It aids in locating downed aircraft by radiating a downward sweeping audio tone, 2-4 times per second. It is designed to function without human action after an accident. (Refer to FAR, Part 91, AIM)

EMERGENCY SAFE ALTITUDE— (See Minimum Safe Altitude)

E-MSAW— (See En Route Minimum Safe Altitude Warning)

EN ROUTE AIR TRAFFIC CONTROL SERVICES— Air traffic control service provided aircraft on IFR flight plans, generally by centers, when these aircraft are operating between departure and destination terminal areas. When equipment, capabilities, and controller workload permit, certain advisory/assistance services may be provided to VFR aircraft. (See NAS Stage A, Air Route Traffic Control Center) (Refer to AIM)

EN ROUTE AUTOMATED RADAR TRACKING SYSTEM/EARTS— An automated radar and radar beacon tracking system. Its functional capabilities and design are essentially the same as the terminal ARTS IIIA system except for the EARTS capability of employing both short-range (ASR) and long-range (ARSR) radars, use of full digital radar displays, and fail-safe design. (See Automated Radar Terminal Systems/ARTS)

EN ROUTE CHARTS— (See Aeronautical Charts)

EN ROUTE DESCENT— Descent from the en route cruising altitude which takes place along the route of flight.

EN ROUTE FLIGHT ADVISORY SERVICE/FLIGHT WATCH— A service specifically designed to provide, upon pilot request, timely weather information pertinent to his type of flight, intended route of flight, and altitude. The FSS's providing this service are listed in the Airport/Facility Directory. (Refer to AIM)

EN ROUTE MINIMUM SAFE ALTITUDE WARNING/E-MSAW— A function of the NAS Stage A en route computer that aids the controller by alerting him when a tracked aircraft is below or predicted by the computer to go below a predetermined minimum IFR altitude (MIA).

*ICAO—ESTIMATED ELAPSED TIME/EET—*The estimated time required to proceed from one significant point to another (for use in international flight planning). (See Total Estimated Elapsed Time)

*ICAO—ESTIMATED OFF-BLOCK TIME—*The estimated time at which the aircraft will commence movement associated with departure (for use in international flight planning).

EXECUTE MISSED APPROACH— Instructions issued to a pilot making an instrument approach which means continue inbound to the missed approach point and execute the missed approach procedure as described on the Instrument Approach Procedure Chart or as previously assigned by ATC. The pilot may climb immediately to the altitude specified in the missed approach procedure upon making a missed approach. No turns should be initiated prior to reaching the missed approach point. When conducting an ASR or PAR approach, execute the assigned missed approach procedure immediately upon receiving instructions to "execute missed approach." (Refer to AIM)

EXPECT (ALTITUDE) AT (TIME) or (FIX)— Used under certain conditions in a departure clearance to provide a pilot with an altitude to be used in the event of two-way communication failure. (Refer to AIM)

EXPECT DEPARTURE CLEARANCE (TIME)/EDCT— Used in the Fuel Advisory Departure (FAD) program. The time the operator can expect a gate release. Excluding long distance flights, an EDCT will always be assigned even though it may be the same as the Estimated Time of Departure (ETD). The EDCT is calculated by adding the ground delay factor. (See Fuel Advisory Departure)

EXPECT FURTHER CLEARANCE (TIME)/EFC— The time a pilot can expect to receive clearance beyond a clearance limit.

EXPECT FURTHER CLEARANCE VIA (AIRWAYS, ROUTES OR FIXES)— Used to inform a pilot of the routing he can expect if any part of the route beyond a short range clearance limit differs from that filed.

EXPEDITE— Used by ATC when prompt compliance is required to avoid the development of an imminent situation.

FAST FILE— A system whereby a pilot files a flight plan via telephone that is tape recorded and then transcribed for transmission to the appropriate air traffic facility. Locations having a fast file capability are contained in the Airport/Facility Directory. (Refer to AIM)

FEATHERED PROPELLER— A propeller whose blades have been rotated so that the leading and trailing edges are nearly parallel with the aircraft flight path to stop or minimize drag and engine rotation. Normally used to indicate shutdown of a reciprocating or turboprop engine due to malfunction.

FEEDER ROUTE— A route depicted on instrument approach procedure charts to designate routes for aircraft to proceed from the en route structure to the initial approach fix (IAF). (See Instrument Approach Procedure)

FERRY FLIGHT— A flight for the purpose of:

1. Returning an aircraft to base,
2. Delivering an aircraft from one location to another.
3. Moving an aircraft to and from a maintenance base.

Ferry flights, under certain conditions, may be conducted under terms of a special flight permit.

FILED— Normally used in conjunction with flight plans, meaning a flight plan has been submitted to ATC.

FILED EN ROUTE DELAY— Any of the following preplanned delays at points/areas along the route of flight which require special flight plan filing and handling techniques.

1. Terminal Area Delay—A delay within a terminal area for touch-and-go, low approach, or other terminal area activity.
2. Special Use Airspace Delay—A delay within a Military Operating Area, Restricted Area, Warning Area, or ATC Assigned Airspace.
3. Aerial Refueling Delay—A delay within an Aerial Refueling Track or Anchor.

FINAL— Commonly used to mean that an aircraft is on the final approach course or is aligned with a landing area. (See Final Approach Course, Final Approach—IFR, Traffic Pattern, Segments of an Instrument Approach Procedure)

FINAL APPROACH COURSE— A published MLS course, a straight line extension of a localizer, a final approach radial/bearing, or a runway centerline all without regard to distance. (See Final Approach—IFR, Traffic Pattern)

FINAL APPROACH FIX/FAF— The fix from which the final approach (IFR) to an airport is executed and which identifies the beginning of the final approach segment. It is designated on Government charts by the Maltese Cross symbol for nonprecision approaches and the lightning bolt symbol for precision approaches; or when ATC directs a lower-than-published Glideslope/path Intercept Altitude, it is the resultant actual point of the glideslope/path intercept. (See Final Approach Point, Glideslope/path Intercept Altitude, Segments of an Instrument Approach Procedure)

FINAL APPROACH—IFR— The flight path of an aircraft which is inbound to an airport on a final instrument approach course, beginning at the final approach fix or point and extending to the airport or the point where a circle-to-land maneuver or a missed approach is executed. (See Segments of an Instrument Approach Procedure, Final Approach Fix, Final Approach Course, Final Approach Point)

ICAO—FINAL APPROACH— That part of an instrument approach procedure from the time the aircraft has:

1. Completed the last procedure turn or base turn, where one is specified, or
2. Crossed a specified fix, or
3. Intercepted the last track specified for the procedures until it has crossed a point in the vicinity of an aerodrome from which:
    a. A landing can be made, or
    b. A missed approach procedure is initiated.

FINAL APPROACH POINT/FAP— The point, applicable only to a nonprecision approach with no depicted FAF (such as an on-airport VOR), where the aircraft is established inbound on the final approach course from the procedure turn and where the final approach descent may be commenced. The FAP serves as the FAF and identifies the beginning of the final approach segment. (See Final Approach Fix, Segments of an Instrument Approach Procedure)

FINAL APPROACH SEGMENT— (See Segments of an Instrument Approach Procedure)

FINAL APPROACH—VFR— (See Traffic Pattern)

FINAL CONTROLLER— The controller providing information and final approach guidance during PAR and ASR approaches utilizing radar equipment. (See Radar Approach)

FIX— A geographical position determined by visual reference to the surface, by reference to one or more radio NAVAIDs, by celestial plotting, or by another navigational device.

FLAG/FLAG ALARM— A warning device incorporated in certain airborne navigation and flight instruments indicating that:

1. Instruments are inoperative or otherwise not operating satisfactorily, or
2. Signal strength or quality of the received signal falls below acceptable values.

FLAMEOUT— Unintended loss of combustion in turbine engines resulting in the loss of engine power.

FLIGHT CHECK— A call-sign prefix used by FAA aircraft engaged in flight inspection/certification of navigational aids and flight procedures. The word "recorded" may be added as a suffix; e.g., "Flight Check 320 recorded" to indicate that an automated flight inspection is in progress in terminal areas. (See Flight Inspection/Flight Check) (Refer to AIM).

FLIGHT INFORMATION REGION/FIR— An airspace of defined dimensions within which Flight Information Service and Alerting Service are provided.

1. Flight Information Service—A service provided for the purpose of giving advice and information useful for the safe and efficient conduct of flights.
2. Alerting Service—A service provided to notify appropriate organizations regarding aircraft in need of search and rescue aid and to assist such organizations as required.

FLIGHT INSPECTION/FLIGHT CHECK— Inflight investigation and evaluation of a navigational aid to determine whether it meets established tolerances. (See Navigational Aid)

FLIGHT LEVEL— A level of constant atmospheric pressure related to a reference datum of 29.92 inches of mercury. Each is stated in three digits that represent hundreds of feet. For example, flight level 250 represents a barometric altimeter indication of 25,000 feet; flight level 255, an indication of 25,500 feet.

ICAO—FLIGHT LEVELS—Surfaces of constant atmospheric pressure which are related to a specific pressure datum, 1013.2 mb (29.92 inches) and are separated by specific pressure intervals.

FLIGHT LINE— A term used to describe the precise movement of a civil photogrammetric aircraft along a predetermined course(s) at a predetermined altitude during the actual photographic run.

FLIGHT PATH— A line, course, or track along which an aircraft is flying or intended to be flown. (See Track, Course)

FLIGHT PLAN— Specified information relating to the intended flight of an aircraft that is filed orally or in writing with an FSS or an ATC facility. (See Fast File, Filed) (Refer to AIM)

FLIGHT RECORDER— A general term applied to any instrument or device that records information about the performance of an aircraft in flight or about conditions encountered in flight. Flight recorders may make records of airspeed, outside air temperature, vertical acceleration, engine RPM, manifold pressure, and other pertinent variables for a given flight.

ICAO—FLIGHT RECORDER—Any type of recorder installed in the aircraft for the purpose of complementing accident/incident investigation.

FLIGHT SERVICE STATION/FSS— Air traffic facilities which provide pilot briefing, en route communications and VFR search and rescue services, assist lost aircraft and aircraft in emergency situations, relay ATC clearances, originate Notices to Airmen, broadcast aviation weather and NAS information, receive and process IFR flight plans, and monitor NAVAID's. In addition, at selected locations FSS's provide Enroute Flight Advisory Service (Flight Watch), take weather observations, issue airport advisories, and advise Customs and Immigration of transborder flights. (Refer to AIM)

FLIGHT STANDARDS DISTRICT OFFICE/FSDO— An FAA field office serving an assigned geographical area and staffed with Flight Standards personnel who serve the aviation industry and the general public on matters relating to the certification and operation of air carrier and general aviation aircraft. Activities include general surveillance of operational safety, certification of airmen and aircraft, accident prevention, investigation, enforcement, etc.

FLIGHT TEST— A flight for the purpose of:

1. Investigating the operation/flight characteristics of an aircraft or aircraft component.
2. Evaluating an applicant for a pilot certificate or rating.

FLIGHT VISIBILITY— (See Visibility)

FLIGHT WATCH— A shortened term for use in air-ground contacts on frequency 122.0 MHz to identify the flight service station providing En Route Flight Advisory Service; e.g., "Oakland Flight Watch." (See En Route Flight Advisory Service)

FLIP— (See DOD FLIP)

FLOW CONTROL— Measures designed to adjust the flow of traffic into a given airspace, along a given route, or bound for a given aerodrome (airport) so as to ensure the most effective utilization of the airspace.

(See Quota Flow Control) (Refer to Airport/Facility Directory

FLY HEADING (DEGREES)— Informs the pilot of the heading he should fly. The pilot may have to turn to, or continue on, a specific compass direction in order to comply with the instructions. The pilot is expected to turn in the shorter direction to the heading unless otherwise instructed by ATC.

FORMATION FLIGHT— More than one aircraft which, by prior arrangement between the pilots, operate as a single aircraft with regard to navigation and position reporting. Separation between aircraft within the formation is the responsibility of the flight leader and the pilots of the other aircraft in the flight. This includes transition periods when aircraft within the formation are maneuvering to attain separation from each other to effect individual control and during join-up and breakaway.

1. A standard formation is one in which a proximity of no more than 1 mile laterally or longitudinally and within 100 feet vertically from the flight leader is maintained by each wingman.
2. Nonstandard formations are those operating under any of the following conditions:
    a. When the flight leader has requested and ATC has approved other than standard formation dimensions.
    b. When operating within an authorized altitude reservation (ALTRV) or under the provisions of a letter of agreement.
    c. When the operations are conducted in airspace specifically designed for a special activity. (See Altitude Reservation) (Refer to FAR Part 91)

FSS— (See Flight Service Station)

FUEL ADVISORY DEPARTURE/FAD— Procedures to minimize engine running time for aircraft destined for an airport experiencing prolonged arrival delays. (Refer to AIM)

FUEL DUMPING— Airborne release of usable fuel. This does not include the dropping of fuel tanks. (See Jettisoning of External Stores)

FUEL SIPHONING/FUEL VENTING— Unintentional release of fuel caused by overflow, puncture, loose cap, etc.

GATE HOLD PROCEDURES— Procedures at selected airports to hold aircraft at the gate or other ground location whenever departure delays exceed or are anticipated to exceed 5 minutes. The sequence for departure will be maintained in accordance with initial call-up unless modified by Flow Control restrictions. Pilots should monitor the ground control/clearance delivery frequency for engine startup advisories or new proposed start time if the delay changes. (See Flow Control)

GENERAL AVIATION— That portion of civil aviation which encompasses all facets of aviation except air carriers holding a certificate of public convenience and necessity from the Civil Aeronautics Board and large aircraft commercial operators.

*ICAO—GENERAL AVIATION—*All civil aviation operations other than scheduled air services and nonscheduled air transport operations for remuneration or hire.

GENERAL AVIATION DISTRICT OFFICE/GADO— An FAA field office serving a designated geographical area and staffed with Flight Standards personnel who have the responsibility for serving the aviation industry and the general public on all matters relating to the certification and operation of general aviation aircraft.

GLIDEPATH, PAR *(ON/ABOVE/BELOW)* Used by ATC to inform an aircraft making a PAR approach of its vertical position (elevation) relative to the descent profile. The terms "slightly" and "well" are used to describe the degree of deviation; e.g., "slightly above glidepath." Trend information is also issued with respect to the elevation of the aircraft and may be modified by the terms "rapidly" and "slowly;" e.g., "well above glidepath, coming down rapidly." (See PAR Approach)

GLIDESLOPE/GLIDEPATH— Provides vertical guidance for aircraft during approach and landing. The glideslope/glidepath is based on the following:

1. Electronic components emitting signals which provide vertical guidance by reference to airborne instruments during instrument approaches such as ILS/MLS, or
2. Visual ground aids, such as VASI, which provide vertical guidance for a VFR approach or for the visual portion of an instrument approach and landing.

ICAO—GLIDE PATH— A descent profile determined for vertical guidance during a final approach.

GLIDESLOPE/GLIDEPATH INTERCEPT ALTITUDE— The minimum altitude to intercept the glideslope/path on a precision approach. The intersection of the published intercept altitude with the glideslope/path, designated on Government charts by the lightning bolt symbol, is the precision FAF; however, when ATC directs a lower altitude, the resultant lower intercept position is then the FAF. (See Final Approach Fix, Segments of an Instrument Approach Procedure)

GO AHEAD— Proceed with your message. Not to be used for any other purpose.

GO AROUND— Instructions for a pilot to abandon his approach to landing. Additional instructions may follow. Unless otherwise advised by ATC, a VFR aircraft or an aircraft conducting visual approach should overfly the runway while climbing to traffic pattern altitude and enter the traffic pattern via the crosswind leg. A pilot on an IFR flight plan making an instrument approach should execute the published missed approach procedure or proceed as instructed by ATC; e.g., "Go around" (additional instructions if required). (See Low Approach, Missed Approach)

GROUND CLUTTER— A pattern produced on the radar scope by ground returns which may degrade other radar returns in the affected area. The effect of ground clutter is minimized by the use of moving target indicator (MTI) circuits in the radar equipment resulting in a radar presentation which displays only targets which are in motion. (See Clutter)

GROUND CONTROLLED APPROACH/GCA— A radar approach system operated from the ground by air traffic control personnel transmitting instructions to the pilot by radio. The approach may be conducted with surveillance radar (ASR) only or with both surveillance and precision approach radar (PAR). Usage of the term "GCA" by pilots is discouraged except when referring to a GCA facility. Pilots should specifically request a "PAR" approach when a precision radar approach is desired or request an "ASR" or "surveillance" approach when a nonprecision radar approach is desired. (See Radar Approach)

GROUND SPEED— The speed of an aircraft relative to the surface of the earth.

GROUND VISIBILITY— (See Visibility)

HANDOFF— An action taken to transfer the radar identification of an aircraft from one controller to another if the aircraft will enter the receiving controller's airspace and radio communications with the aircraft will be transferred.

HAVE NUMBERS— Used by pilots to inform ATC that they have received runway, wind, and altimeter information only.

HEAVY (AIRCRAFT)— (See Aircraft Classes)

HEIGHT ABOVE AIRPORT/HAA— The height of the Minimum Descent Altitude above the published airport elevation. This is published in conjunction with circling minimums. (See Minimum Descent Altitude)

HEIGHT ABOVE LANDING/HAL— The height above a designated helicopter landing area used for helicopter instrument approach procedures. (Refer to FAR Part 97)

HEIGHT ABOVE TOUCHDOWN/HAT— The height of the Decision Height or Minimum Descent Altitude above the highest runway elevation in the touchdown zone (first 3,000 feet of the runway). HAT is published on instrument approach charts in conjunction with all straight-in minimums. (See Decision Height, Minimum Descent Altitude)

HELICOPTER/COPTER— Rotorcraft that, for its horizontal motion, depends principally on its engine-driven rotors.

*ICAO—HELICOPTER—*A heavier-than-air aircraft supported in flight by the reactions of the air on one or more power-driven rotors on substantially vertical axes.

HELIPAD— A small, designated area, usually with a prepared surface, on a heliport, airport, landing/takeoff area, apron/ramp, or movement area used for takeoff, landing, or parking of helicopters.

HELIPORT— An area of land, water, or structure used or intended to be used for the landing and takeoff of helicopters and includes its buildings and facilities if any.

HERTZ/Hz— The standard radio equivalent of frequency in cycles per second of an electromagnetic wave. Kilohertz (kHz) is a frequency of one thousand cycles per second. Megahertz (MHz) is a frequency of one million cycles per second.

HIGH FREQUENCY/HF— The frequency band between 3 and 30 MHz. (See High Frequency Communications)

HIGH FREQUENCY COMMUNICATIONS/HF COMMUNICATIONS— High radio frequencies (HF) between 3 and 30 MHz used for air-to-ground voice communication in overseas operations.

HIGH SPEED TAXIWAY/EXIT/TURNOFF— A long radius taxiway designed and provided with lighting or marking to define the path of aircraft, traveling at high speed (up to 60 knots), from the runway center to a point on the center of a taxiway. Also referred to as long radius exit or turn-off taxiway. The high speed taxiway is designed to expedite aircraft turning off the runway after landing, thus reducing runway occupancy time.

HOLD/HOLDING PROCEDURE— A predetermined maneuver which keeps aircraft within a specified airspace while awaiting further clearance from air traffic control. Also used during ground operations to keep aircraft within a specified area or at a specified point while awaiting further clearance from air traffic control. (See Holding Fix) (Refer to AIM)

HOLDING FIX— A specified fix identifiable to a pilot by NAVAID's or visual reference to the ground used as a reference point in establishing and maintaining the position of an aircraft while holding. (See Fix, Hold, Visual Holding) (Refer to AIM)

ICAO—HOLDING POINT— A specified location, identified by visual or other means, in the vicinity of which the position of an aircraft in flight is maintained with air traffic control clearances.

HOMING— Flight toward a NAVAID, without correcting for wind, by adjusting the aircraft heading to maintain a relative bearing of zero degrees. (See Bearing)

*ICAO—HOMING—*The procedure of using the direction-finding equipment of one radio station with the emission of another radio station, where at least one of the stations is mobile, and whereby the mobile station proceeds continuously towards the other station.

HOVER CHECK— Used to describe when a helicopter/VTOL aircraft requires a stabilized hover to conduct a performance/power check prior to hover taxi, air taxi, or takeoff. Altitude of the hover will vary based on the purpose of the check.

HOVER TAXI— Used to describe a helicopter/VTOL aircraft movement conducted above the surface and in ground effect at airspeeds less than approximately 20 knots. The actual height may vary, and some helicopters may require hover taxi above 25 feet AGL to reduce ground effect turbulence or provide clearance for cargo slingloads. (See Air Taxi, Hover Check) (Refer to AIM)

HOW DO YOU HEAR ME?— A question relating to the quality of the transmission or to determine how well the transmission is being received.

IDENT— A request for a pilot to activate the aircraft transponder identification feature. This will help the controller to confirm an aircraft identity or to identify an aircraft. (Refer to AIM)

IDENT FEATURE— The special feature in the Air Traffic Control Radar Beacon System (ATCRBS) equipment. It is used to immediately distinguish one displayed beacon target from other beacon targets. (See Ident)

IF FEASIBLE, REDUCE SPEED TO (SPEED)— (See Speed Adjustment)

IF NO TRANSMISSION RECEIVED FOR (TIME)— Used by ATC in radar approaches to prefix procedures which should be followed by the pilot in event of lost communications. (See Lost Communications)

IFR AIRCRAFT/IFR FLIGHT— An aircraft conducting flight in accordance with instrument flight rules.

IFR CONDITIONS— Weather conditions below the minimum for flight under visual flight rules. (See Instrument Meteorological Conditions)

IFR DEPARTURE PROCEDURE— (See IFR Takeoff Minimums and Departure Procedures) (Refer to AIM)

IFR MILITARY TRAINING ROUTES (IR)— Routes used by the Department of Defense and associated Reserve and Air Guard units for the purpose of conducting low-altitude navigation and tactical training in both IFR and VFR weather conditions below 10,000 feet MSL at airspeeds in excess of 250 knots IAS.

IFR TAKEOFF MINIMUMS AND DEPARTURE PROCEDURES— FAR, Part 91, prescribes standard takeoff rules for certain civil users. At some airports, obstructions or other factors require the establishment of nonstandard takeoff minimums, departure procedures, or both to assist pilots in avoiding obstacles during climb to the minimum en route altitude. Those airports are listed in NOS/DOD Instrument Approach Charts (IAP's) under a section entitled "IFR Takeoff Minimums and Departure Procedures." The NOS/DOD IAP chart legend illustrates the symbol used to alert the pilot to nonstandard takeoff minimums and departure procedures. When departing IFR from such airports or from any airports where there are no departure procedures, SID's, or ATC facilities available, pilots should advise ATC of any departure limitations. Controllers may query a pilot to determine acceptable departure directions, turns, or headings after takeoff. Pilots should be familiar with the departure procedures and must assure that their aircraft can meet or exceed any specified climb gradients.

ILS CATEGORIES—

1. ILS Category I—An ILS approach procedure which provides for approach to a height above touchdown of not less than 200 feet and with runway visual range of not less than 1,800 feet.
2. ILS Category II—An ILS approach procedure which provides for approach to a height above touchdown of not less than 100 feet and with runway visual range of not less than 1,200 feet.
3. ILS Category III.
   a. IIIA—An ILS approach procedure which provides for approach without a decision height minimum and with runway visual range of not less than 700 feet.
   b. IIIB—An ILS approach procedure which provides for approach without a decision height minimum and with runway visual range of not less than 150 feet.
   c. IIIC—An ILS approach procedure which provides for approach without a decision height minimum and without runway visual range minimum.

IMMEDIATELY— Used by ATC when such action compliance is required to avoid an imminent situation.

INCREASE SPEED TO (SPEED)— (See Speed Adjustment)

INFORMATION REQUEST/INREQ— A request originated by an FSS for information concerning an overdue VFR aircraft.

INITIAL APPROACH FIX/IAF— The fixes depicted on instrument approach procedure charts that identify the beginning of the initial approach segment(s). (See Fix, Segments of an Instrument Approach Procedure)

INITIAL APPROACH SEGMENT— (See Segments of an Instrument Approach Procedure)

INNER MARKER/IM/INNER MARKER BEACON— A marker beacon used with an ILS (CAT II) precision approach located between the middle marker and the end of the ILS runway, transmitting a radiation pattern keyed at six dots per second and indicating to the pilot, both aurally and visually, that he is at the designated decision height (DH), normally 100 feet above the touchdown zone elevation, on the ILS CAT II approach. It also marks progress during a CAT III approach. (See Instrument Landing System) (Refer to AIM)

INSTRUMENT APPROACH PROCEDURE/IAP/INSTRUMENT APPROACH— A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing or to a point from which a landing may be made visually. It is prescribed and approved for a specific airport by competent authority. (See Segments of an Instrument Approach Procedure) (Refer to FAR, Part 91, AIM)

1. U. S. civil standard instrument approach procedures are approved by the FAA as prescribed under FAR, Part 97 and are available for public use.

2. U.S. military standard instrument approach procedures are approved and published by the Department of Defense.

3. Special instrument approach procedures are approved by the FAA for individual operators but are not published in FAR, Part 97 for public use.

ICAO—INSTRUMENT APPROACH PROCEDURE— A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing, or to a point from which a landing may be made visually.

INSTRUMENT FLIGHT RULES/IFR— Rules governing the procedures for conducting instrument flight. Also a term used by pilots and controllers to indicate type of flight plan. (See Visual Flight Rules, Instrument Meteorological Conditions, Visual Meteorological Conditions) (Refer to AIM)

*ICAO—INSTRUMENT FLIGHT RULES—*A set of rules governing the conduct of flight under instrument meteorological conditions.

INSTRUMENT LANDING SYSTEM/ILS— A precision instrument approach system which normally consists of the following electronic components and visual aids:

1. Localizer. (See Localizer)
2. Glideslope. (See Glideslope)
3. Outer Marker. (See Outer Marker)
4. Middle Marker. (See Middle Marker)
5. Approach Lights. (See Airport Lighting)

(Refer to FAR Part 91, AIM)

INSTRUMENT METEOROLOGICAL CONDITIONS/IMC— Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling less than the minima specified for visual meteorological conditions. (See Visual Meteorological Conditions, Instrument Flight Rules, Visual Flight Rules)

INSTRUMENT RUNWAY— A runway equipped with electronic and visual navigation aids for which a precision or nonprecision approach procedure having straight-in landing minimums has been approved.

*ICAO—INSTRUMENT RUNWAY—*A runway intended for the operation of aircraft using nonvisual aids and comprising:

1. Instrument Approach Runway—An instrument runway served by a nonvisual aid providing at least directional guidance adequate for a straight-in approach.
2. Precision Approach Runway, Category I—An instrument runway served by ILS or GCA approach aids and visual aids intended for operations down to 60 metres (200 feet) decision height and down to an RVR of the order of 800 metres (2,600 feet.)
3. Precision Approach Runway, Category II—An instrument runway served by ILS and visual aids intended for operations down to 30 metres (100 feet) decision height and down to an RVR of the order of 400 metres (1,200 feet.)
4. Precision Approach Runway, Category III—An instrument runway served by ILS (no decision height being applicable) and:
    a. By visual aids intended for operations down to an RVR of the order of 200 metres (700 feet);
    b. By visual aids intended for operations down to an RVR of the order of 50 metres (150 feet);
    c. Intended for operations without reliance on external visual reference.

INTERMEDIATE APPROACH SEGMENT— (See Segments of an Instrument Approach Procedure)

INTERMEDIATE FIX/IF— The fix that identifies the beginning of the intermediate approach segment of an instrument approach procedure. The fix is not normally identified on the instrument approach chart as an intermediate fix (IF). (See Segments of an Instrument Approach Procedure)

INTERNATIONAL AIRPORT— Relating to international flight, it means:

1. An airport of entry which has been designated by the Secretary of Treasury or Commissioner of Customs as an international airport for customs service.
2. A landing rights airport at which specific permission to land must be obtained from customs authorities in advance of contemplated use.
3. Airports designated under the Convention on International Civil Aviation as an airport for use by international commercial air transport and/or international general aviation. (Refer to Airport/Facility Directory and IFIM).

*ICAO—INTERNATIONAL AIRPORT—*Any airport designated by the Contracting State in whose territory it is situated as an airport of entry and departure for international air traffic, where the formalities incident to customs, immigration, public health, animal and plant quarantine, and similar procedures are carried out.

INTERNATIONAL CIVIL AVIATION ORGANIZATION/ICAO— A specialized agency of the United Nations whose objective is to develop the principles and techniques of international air navigation and to foster planning and development of international civil air transport.

INTERNATIONAL FLIGHT INFORMATION MANUAL/IFIM— A publication designed primarily as a pilot's preflight planning guide for flights into foreign airspace and for flights returning to the U.S. from foreign locations.

INTERROGATOR— The ground-based surveillance radar beacon transmitter-receiver, which normally scans in synchronism with a primary radar, transmitting discrete radio signals which repetitiously request all transponders on the mode being used to reply. The replies received are mixed with the primary radar returns and displayed on the same plan position indicator (radar scope). Also, applied to the airborne element of the TACAN/DME system. (See Transponder) (Refer to AIM)

INTERSECTING RUNWAYS— Two or more runways which cross or meet within their lengths. (See Intersection)

INTERSECTION—

1. A point defined by any combination of courses, radials, or bearings of two or more navigational aids.
2. Used to describe the point where two runways, a runway and a taxiway, or two taxiways cross or meet.

INTERSECTION DEPARTURE/INTERSECTION TAKEOFF— A takeoff or proposed takeoff on a runway from an intersection. (See Intersection)

I SAY AGAIN— The message will be repeated.

JAMMING— Electronic or mechanical interference which may disrupt the display of aircraft on radar or the transmission/reception of radio communications/navigation.

JET BLAST— Jet engine exhaust (thrust stream turbulence). (See Wake Turbulence)

JET ROUTE— A route designed to serve aircraft operations from 18,000 feet MSL up to and including flight level 450. The routes are referred to as "J" routes with numbering to identify the designated route; e.g., J105. (See Route) (Refer to FAR Part 71)

JET STREAM— A migrating stream of high-speed winds present at high altitudes.

JETTISONING OF EXTERNAL STORES— Airborne release of external stores; e.g., tiptanks, ordnance. (See Fuel Dumping) (Refer to FAR Part 91)

JOINT USE RESTRICTED AREA— (See Restricted Area)

KNOWN TRAFFIC— With respect to ATC clearances, means aircraft whose altitude, position, and intentions are known to ATC.

LANDING/TAKEOFF AREA— Any locality either on land, water, or structures, including airports/heliports and intermediate landing fields, which is used, or intended to be used, for the landing and takeoff of aircraft whether or not facilities are provided for the shelter, servicing, or for receiving or discharging passengers or cargo.

ICAO—LANDING AREA—That part of the movement area intended for the landing and takeoff of aircraft.

LANDING DIRECTION INDICATOR— A device which visually indicates the direction in which landings and takeoffs should be made. (See Tetrahedron) (Refer to AIM)

LANDING MINIMUMS/IFR LANDING MINIMUMS— The minimum visibility prescribed for landing a civil aircraft while using an instrument approach procedure. The minimum applies with other limitations set forth in FAR Part 91 with respect to the Minimum Descent Altitude (MDA) or Decision Height (DH) prescribed in the instrument approach procedures as follows:

1. Straight-in landing minimums—A statement of MDA and visibility, or DH and visibility, required for a straight-in landing on a specified runway, or
2. Circling minimums— A statement of MDA and visibility required for the circle-to-land maneuver.

Descent below the established MDA or DH is not authorized during an approach unless the aircraft is in a position from which a normal approach to the runway of intended landing can be made and adequate visual reference to required visual cues is maintained. (See Straight-in Landing, Circle-to-Land Maneuver, Decision Height, Minimum Descent Altitude, Visibility, Instrument Approach Procedure) (Refer to FAR Part 91)

LANDING ROLL— The distance from the point of touchdown to the point where the aircraft can be brought to a stop or exit the runway.

LANDING SEQUENCE— The order in which aircraft are positioned for landing. (See Approach Sequence)

LAST ASSIGNED ALTITUDE— The last altitude/flight level assigned by ATC and acknowledged by the pilot. (See Maintain) (Refer to FAR Part 91)

LATERAL SEPARATION— The lateral spacing of aircraft at the same altitude by requiring operation on different routes or in different geographical locations. (See Separation)

LIGHTED AIRPORT— An airport where runway and obstruction lighting is available. (See Airport Lighting) (Refer to AIM)

LIGHT GUN— A handheld directional light signaling device which emits a brilliant narrow beam of white, green, or red light as selected by the tower controller. The color and type of light transmitted can be used to approve or disapprove anticipated pilot actions where radio communication is not available. The light gun is used for controlling traffic operating in the vicinity of the airport and on the airport movement area. (Refer to AIM)

LOCALIZER— The component of an ILS which provides course guidance to the runway. (See Instrument Landing System) (Refer to AIM)

ICAO—LOCALIZER COURSE (ILS)— The locus of points, in any given horizontal plane, at which the DDM (difference in depth of modulation) is zero.

LOCALIZER TYPE DIRECTIONAL AID/LDA— A NAVAID used for nonprecision instrument approaches with utility and accuracy comparable to a localizer but which is not a part of a complete ILS and is not aligned with the runway. (Refer to AIM)

LOCALIZER USABLE DISTANCE— The maximum distance from the localizer transmitter at a specified altitude, as verified by flight inspection, at which reliable course information is continuously received. (Refer to AIM)

LOCAL TRAFFIC— Aircraft operating in the traffic pattern or within sight of the tower, or aircraft known to be departing or arriving from flight in local practice areas, or aircraft executing practice instrument approaches at the airport. (See Traffic Pattern)

LONGITUDINAL SEPARATION— The longitudinal spacing of aircraft at the same altitude by a minimum distance expressed in units of time or miles. (See Separation) (Refer to AIM)

LORAN/LONG RANGE NAVIGATION— An electronic navigational system by which hyperbolic lines of position are determined by measuring the difference in the time of reception of synchronized pulse signals from two fixed transmitters. Loran A operates in the 1750—1950 kHz frequency band. Loran C and D operate in the 100—110 kHz frequency band. (Refer to AIM)

LOST COMMUNICATIONS/TWO-WAY RADIO COMMUNICATIONS FAILURE— Loss of the ability to communicate by radio. Aircraft are sometimes referred to as NORDO (No Radio). Standard pilot procedures are specified in FAR Part 91. Radar controllers issue procedures for pilots to follow in the event of lost communications during a radar approach when weather reports indicate that an aircraft will likely encounter IFR weather conditions during the approach. (Refer to FAR Part 91, AIM)

LOW ALTITUDE AIRWAY STRUCTURE/FEDERAL AIRWAYS— The network of airways serving aircraft operations up to but not including 18,000 feet MSL. (See Airway) (Refer to AIM)

LOW ALTITUDE ALERT, CHECK YOUR ALTITUDE IMMEDIATELY— (See Safety Alert)

LOW ALTITUDE ALERT SYSTEM/LAAS— An automated function of the TPX-42 that alerts the controller when a Mode C transponder-equipped aircraft on an IFR flight plan is below a predetermined minimum safe altitude. If requested by the pilot, LAAS monitoring is also available to VFR Mode C transponder-equipped aircraft.

LOW APPROACH— An approach over an airport or runway following an instrument approach or a VFR approach including the go-around maneuver where the pilot intentionally does not make contact with the runway. (Refer to AIM)

LOW FREQUENCY/LF— The frequency band between 30 and 300 kHz. (Refer to AIM)

MACH NUMBER— The ratio of true airspeed to the speed of sound; e.g., MACH .82, MACH 1.6. (See Airspeed)

MAINTAIN—

1. Concerning altitude/flight level, the term means to remain at the altitude/flight level specified. The phrase "climb and" or "descend and" normally precedes "maintain" and the altitude assignment; e.g., "descend and maintain 5,000."
2. Concerning other ATC instructions, the term is used in its literal sense; e.g., maintain VFR.

MAKE SHORT APPROACH— Used by ATC to inform a pilot to alter his traffic pattern so as to make a short final approach. (See Traffic Pattern)

MANDATORY ALTITUDE— An altitude depicted on an instrument Approach Procedure Chart requiring the aircraft to maintain altitude at the depicted value.

MARKER BEACON— An electronic navigation facility transmitting a 75 MHz vertical fan or boneshaped radiation pattern. Marker beacons are identified by their modulation frequency and keying code, and when received by compatible airborne equipment, indicate to the pilot, both aurally and visually, that he is passing over the facility. (See Outer Marker, Middle Marker, Inner Marker) (Refer to AIM)

MAXIMUM AUTHORIZED ALTITUDE/MAA— A published altitude representing the maximum usable altitude or flight level for an airspace structure or route segment. It is the highest altitude on a Federal airway, jet route, area navigation low or high route, or other direct route for which an MEA is designated in FAR Part 95 at which adequate reception of navigation aid signals is assured.

MAYDAY— The international radiotelephony distress signal. When repeated three times, it indicates imminent and grave danger and that immediate assistance is requested. (See Pan-Pan) (Refer to AIM)

METEOROLOGICAL IMPACT STATEMENT/MIS— An unscheduled planning forecast describing conditions expected to begin within 4 to 12 hours which may impact the flow of air traffic in a specific center's (ARTCC) area.

METERING— A method of time-regulating arrival traffic flow into a terminal area so as not to exceed a predetermined terminal acceptance rate.

METERING FIX— A fix along an established route from over which aircraft will be metered prior to entering terminal airspace. Normally, this fix should be established at a distance from the airport which will facilitate a profile descent 10,000 feet above airport elevation (AAE) or above.

MIA— (See Minimum IFR Altitudes)

MICROWAVE LANDING SYSTEM/MLS— A precision instrument approach system operating in the microwave spectrum which normally consists of the following components:

1. Azimuth Station.
2. Elevation Station.
3. Precision Distance Measuring Equipment. (See MLS Categories)

MIDDLE COMPASS LOCATOR— (See Compass Locator)

MIDDLE MARKER/MM— A marker beacon that defines a point along the glide slope of an ILS normally located at or near the point of decision height (ILS Category I). It is keyed to transmit alternate dots and dashes, with the alternate dots and dashes keyed at the rate of 95 dot/dash combinations per minute on a 1300 Hz tone, which is received aurally and visually by compatible airborne equipment. (See Marker Beacon, Instrument Landing System) (Refer to AIM)

MID RVR— (See Visibility)

MILITARY AUTHORITY ASSUMES RESPONSIBILITY FOR SEPARATION OF AIRCRAFT/MARSA— A condition whereby the military services involved assume responsibility for separation between participating military aircraft in the ATC system. It is used only for required IFR operations which are specified in letters of agreement or other appropriate FAA or military documents.

MILITARY OPERATIONS AREA/MOA— (See Special Use Airspace)

MILITARY TRAINING ROUTES/MTR— Airspace of defined vertical and lateral dimensions established for the conduct of military flight training at airspeeds in excess of 250 knots IAS. (See IFR (IR) and VFR (VR) Military Training Routes)

MINIMUM CROSSING ALTITUDE/MCA— The lowest altitude at certain fixes at which an aircraft must cross when proceeding in the direction of a higher minimum en route IFR altitude (MEA). (See Minimum En Route IFR Altitude)

MINIMUM DESCENT ALTITUDE/MDA— The lowest altitude, expressed in feet above mean sea level, to which descent is authorized on final approach or during circle-to-land maneuvering in execution of a standard instrument approach procedure where no electronic glide slope is provided. (See Nonprecision Approach Procedure)

MINIMUM EN ROUTE IFR ALTITUDE/MEA— The lowest published altitude between radio fixes which assures acceptable navigational signal coverage and meets obstacle clearance requirements between those fixes. The MEA prescribed for a Federal airway or segment thereof, area navigation low or high route, or other direct route applies to the entire width of the airway, segment, or route between the radio fixes defining the airway, segment, or route. (Refer to FAR Parts 91 and 95; AIM)

MINIMUM FUEL— Indicates that an aircraft's fuel supply has reached a state where, upon reaching the destination, it can accept little or no delay. This is not an emergency situation but merely indicates an emergency situation is possible should any undue delay occur. (Refer to AIM)

MINIMUM HOLDING ALTITUDE/MHA— The lowest altitude prescribed for a holding pattern which assures navigational signal coverage, communications, and meets obstacle clearance requirements.

MINIMUM IFR ALTITUDES/MIA— Minimum altitudes for IFR operations as prescribed in FAR Part 91. These altitudes are published on aeronautical charts and prescribed in FAR Part 95 for airways and routes, and in FAR Part 97 for standard instrument approach procedures. If no applicable minimum altitude is prescribed in FAR Parts 95 or 97, the following minimum IFR altitude applies:

1. In designated mountainous areas, 2,000 feet above the highest obstacle within a horizontal distance of 5 statute miles from the course to be flown; or
2. Other than mountainous areas, 1,000 feet above the highest obstacle within a horizontal distance of 5 statute miles from the course to be flown; or
3. As otherwise authorized by the Administrator or assigned by ATC. (See Minimum En Route IFR Altitude, Minimum Obstruction Clearance Altitude, Minimum Crossing Altitude, Minimum Safe Altitude, Minimum Vectoring Altitude) (Refer to FAR Part 91)

MINIMUM OBSTRUCTION CLEARANCE ALTITUDE/MOCA— The lowest published altitude in effect between radio fixes on VOR airways, off-airway routes, or route segments which meets obstacle clearance requirements for the entire route segment and which assures acceptable navigational signal coverage only within 25 statute (22 nautical) miles of a VOR. (Refer to FAR Part 91 and 95)

MINIMUM RECEPTION ALTITUDE/MRA— The lowest altitude at which an intersection can be determined. (Refer to FAR Part 95)

MINIMUM SAFE ALTITUDE/MSA—

1. The minimum altitude specified in FAR Part 91 for various aircraft operations.
2. Altitudes depicted on approach charts which provide at least 1,000 feet of obstacle clearance for emergency use within a specified distance from the navigation facility upon which a procedure is predicated. These altitudes will be identified as Minimum Sector Altitudes or Emergency Safe Altitudes and are established as follows:
   a. Minimum Sector Altitudes—Altitudes depicted on approach charts which provide at least 1,000 feet of obstacle clearance within a 25-mile radius of the navigation facility upon which the procedure is predicated. Sectors depicted on approach charts must be at least 90 degrees in scope. These altitudes are for emergency use only and do not necessarily assure acceptable navigational signal coverage.

ICAO—MINIMUM SECTOR ALTITUDE— The lowest altitude which may be used under emergency conditions which will provide a minimum clearance of 300 meters (1,000 feet) above all obstacles located in an area contained within a sector of a circle of 25 nautical mile radius centered on a radio aid to navigation.

   b. Emergency Safe Altitudes—Altitudes depicted on approach charts which provide at least 1,000 feet of obstacle clearance in nonmountainous areas and 2,000 feet of obstacle clearance in designated mountainous areas within a 100-mile radius of the navigation facility upon which the procedure is predicated and normally used only in military procedures. These altitudes are identified on published procedures as "Emergency Safe Altitudes."

MINIMUM SAFE ALTITUDE WARNING (MSAW)— A function of the ARTS III computer that aids the controller by alerting him when a tracked Mode C-equipped aircraft is below or is predicted by the computer to go below a predetermined minimum safe altitude. (Refer to AIM)

MINIMUMS/MINIMA— Weather condition requirements established for a particular operation or type of operation; e.g., IFR takeoff or landing, alternate airport for IFR flight plans, VFR flight, etc. (See Landing Minimums, IFR Takeoff Minimums, VFR Conditions, IFR Conditions) (Refer to FAR Part 91, AIM)

MINIMUM VECTORING ALTITUDE/MVA— The lowest MSL altitude at which an IFR aircraft will be vectored by a radar controller, except as otherwise authorized for radar approaches, departures, and missed approaches. The altitude meets IFR obstacle clearance criteria. It may be lower than the published MEA along an airway or J-route segment. It may be utilized for radar vectoring only upon the controller's determination that an adequate radar return is being received from the aircraft being controlled. Charts depicting minimum vectoring altitudes are normally available only to the controllers and not to pilots. (Refer to AIM)

MISSED APPROACH—

1. A maneuver conducted by a pilot when an instrument approach cannot be completed to a landing. The route of flight and altitude are shown on instrument approach procedure charts. A pilot executing a missed approach prior to the Missed Approach Point (MAP) must continue along the final approach to the MAP. The pilot may climb immediately to the altitude specified in the missed approach procedure.
2. A term used by the pilot to inform ATC that he is executing the missed approach.
3. At locations where ATC radar service is provided, the pilot should conform to radar vectors when provided by ATC in lieu of the published missed approach procedure. (See Missed Approach Point) (Refer to AIM)

ICAO—MISSED APPROACH PROCEDURE— The procedure to be followed if, after an instrument approach, a landing is not effected, and occuring normally:

1. When the aircraft has descended to the decision height and has not established visual contact, or
2. When directed by air traffic control to pull up or to go around again.

MISSED APPROACH POINT/MAP— A point prescribed in each instrument approach procedure at which a missed approach procedure shall be executed if the required visual reference does not exist. (See Missed Approach, Segments of an Instrument Approach Procedure)

MISSED APPROACH SEGMENT— (See Segments of an Instrument Approach Procedure)

MLS—(See Microwave Landing System)

MLS CATEGORIES—

1. MLS Category I—An MLS approach procedure which provides for an approach to a height above touchdown of not less than 200 feet and a runway visual range of not less than 1,800 feet.
2. MLS Category II—Undefined until data gathering/analysis completion.
3. MLS Category III—Undefined until data gathering/analysis completion.

MODE— The letter or number assigned to a specific pulse spacing of radio signals transmitted or received by ground interrogator or airborne transponder components of the Air Traffic Control Radar Beacon System (ATCRBS). Mode A (military Mode 3) and Mode C (altitude reporting) are used in air traffic control. (See Transponder, Interrogator, Radar) (Refer to AIM)

ICAO—MODE (SSR MODE)— The letter or number assigned to a specific pulse spacing of the interrogation signals transmitted by an interrogator. There are 4 modes, A, B, C and D corresponding to four different interrogation pulse spacings.

MOVEMENT AREA— The runways, taxiways, and other areas of an airport/heliport which are utilized for taxiing/hover taxiing, air taxiing, takeoff, and landing of aircraft, exclusive of loading ramps and parking areas. At those airports/heliports with a tower, specific approval for entry onto the movement area must be obtained from ATC.

ICAO—MOVEMENT AREA— That part of an aerodrome intended for the surface movement of aircraft, including the maneuvering area and aprons.

MOVING TARGET INDICATOR/MTI— An electronic device which will permit radar scope presentation only from targets which are in motion. A partial remedy for ground clutter.

MSAW— (See Minimum Safe Altitude Warning)

NAS STAGE A— The en route ATC system's radar, computers and computer programs, controller plan view displays (PVDs/Radar Scopes), input/output devices, and the related communications equipment which are integrated to form the heart of the automated IFR air traffic control system. This equipment performs Flight Data Processing (FDP) and Radar Data Processing (RDP). It interfaces with automated terminal systems and is used in the control of en route IFR aircraft. (Refer to AIM)

NATIONAL AIRSPACE SYSTEM/NAS— The common network of U.S. airspace; air navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information and services; rules, regulations and procedures, technical information, and manpower and material. Included are system components shared jointly with the military.

NATIONAL BEACON CODE ALLOCATION PLAN AIRSPACE/NBCAP AIRSPACE— Airspace over United States territory located within the North American continent between Canada and Mexico, including adjacent territorial waters outward to about boundaries of oceanic control areas (CTA)/Flight Information Regions (FIR). (See Flight Information Region)

NATIONAL FLIGHT DATA CENTER/NFDC— A facility in Washington D.C., established by FAA to operate a central aeronautical information service for the collection, validation, and dissemination of aeronautical data in support of the activities of government, industry, and the aviation community. The information is published in the National Flight Data Digest. (See National Flight Data Digest)

NATIONAL FLIGHT DATA DIGEST/NFDD— A daily (except weekends and Federal holidays) publication of flight information appropriate to aeronautical charts, aeronautical publications, Notices to Airmen, or other media serving the purpose of providing operational flight data essential to safe and efficient aircraft operations.

NATIONAL SEARCH AND RESCUE PLAN— An interagency agreement which provides for the effective utilization of all available facilities in all types of search and rescue missions.

NAVAID CLASSES— VOR, VORTAC, and TACAN aids are classed according to their operational use. The three classes of NAVAID's are:

T—Terminal.

L—Low altitude.

H—High altitude.

The normal service range for T, L, and H class aids is found in the AIM. Certain operational requirements make it necessary to use some of these aids at greater service ranges than specified. Extended range is made possible through flight inspection determinations. Some aids also have lesser service range due to location, terrain, frequency protection, etc. Restrictions to service range are listed in Airport/Facility Directory.

NAVIGABLE AIRSPACE— Airspace at and above the minimum flight altitudes prescribed in the FAR's including airspace needed for safe takeoff and landing. (Refer to FAR Part 91)

NAVIGATIONAL AID/NAVAID— Any visual or electronic device airborne or on the surface which provides point-to- point guidance information or position data to aircraft in flight. (See Air Navigation Facility)

NDB— (See Nondirectional Beacon)

NEGATIVE— "No," or "permission not granted," or "that is not correct."

NEGATIVE CONTACT— Used by pilots to inform ATC that:

1. Previously issued traffic is not in sight. It may be followed by the pilot's request for the controller to provide assistance in avoiding the traffic.
2. They were unable to contact ATC on a particular frequency.

NIGHT— The time between the end of evening civil twilight and the beginning of morning civil twilight, as published in the American Air Almanac, converted to local time.

ICAO—NIGHT— The hours between the end of evening civil twilight and the beginning of morning civil twilight or such other period between sunset and sunrise as may be specified by the appropriate authority.

NO GYRO APPROACH/VECTOR— A radar approach/vector provided in case of a malfunctioning gyro-compass or directional gyro. Instead of providing the pilot with headings to be flown, the controller observes the radar track and issues control instructions "turn right/left" or "stop turn" as appropriate. (Refer to AIM)

NONAPPROACH CONTROL TOWER— Authorizes aircraft to land or takeoff at the airport controlled by the tower or to transit the airport traffic area. The primary function of a nonapproach control tower is the sequencing of aircraft in the traffic pattern and on the landing area. Nonapproach control towers also separate aircraft operating under instrument flight rules clearances from approach controls and centers. They provide ground control services to aircraft, vehicles, personnel, and equipment on the airport movement area.

NONCOMPOSITE SEPARATION— Separation in accordance with minima other than the composite separation minimum specified for the area concerned.

NONDIRECTIONAL BEACON/RADIO BEACON/NDB— An L/MF or UHF radio beacon transmitting nondirectional signals whereby the pilot of an aircraft equipped with direction finding equipment can determine his bearing to or from the radio beacon and "home" on or track to or from the station. When the radio beacon is installed in conjunction with the Instrument Landing System marker, it is normally called a Compass Locator. (See Compass Locator, Automatic Direction Finder)

NONPRECISION APPROACH PROCEDURE/NONPRECISION APPROACH— A standard instrument approach procedure in which no electronic glide slope is provided; e.g., VOR, TACAN, NDB, LOC, ASR, LDA, or SDF approaches.

NONRADAR— Precedes other terms and generally means without the use of radar, such as:

1. Nonradar Route—A flight path or route over which the pilot is performing his own navigation. The pilot may be receiving radar separation, radar monitoring, or other ATC services while on a nonradar route. (See Radar Route)
2. Nonradar Approach—Used to describe instrument approaches for which course guidance on final approach is not provided by ground- based precision or surveillance radar. Radar vectors to the final approach course may or may not be provided by ATC. Examples of nonradar approaches are VOR, NDB, TACAN, and ILS/MLS approaches. (See Final Approach—IFR, Final Approach Course, Radar Approach, Instrument Approach Procedure)
3. Nonradar Separation—The spacing of aircraft in accordance with established minima without the use of radar; e.g., vertical, lateral, or longitudinal separation. (See Radar Separation)

ICAO—NonRadar Separation— The separation used when aircraft position information is derived from sources other than radar.

4. Nonradar Arrival—An arriving aircraft that is not being vectored to the final approach course for an instrument approach or towards the airport for a visual approach. The aircraft may or may not be in a radar environment and may or may not be receiving radar separation, radar monitoring, or other services provided by ATC. (See Radar Arrival, Radar Environment)

NONRADAR APPROACH CONTROL— An ATC facility providing approach control service without the use of radar. (See Approach Control, Approach Control Service)

NORDO— (See Lost Communications)

NORTH AMERICAN ROUTE— A numerically coded route preplanned over existing airway and route systems to and from specific coastal fixes serving the North Atlantic. North American Routes consist of the following:

1. Common Route/Portion—That segment of a North American Route between the inland navigation facility and the coastal fix.
2. Non-Common Route/Portion—That segment of a North American Route between the inland navigation facility and a designated North American terminal.
3. Inland Navigation Facility—A navigation aid on a North American Route at which the common route and/or the non-common route begins or ends.
4. Coastal Fix—A navigation aid or intersection where an aircraft transitions between the domestic route structure and the oceanic route structure.

NOTICES TO AIRMEN PUBLICATION— A publication designed primarily as a pilot's operational manual containing current NOTAM information considered essential to the safety of flight as well as supplemental data to other aeronautical publications. (See Notice to Airmen/NOTAM)

NOTICE TO AIRMEN/NOTAM— A notice containing information (not known sufficiently in advance to publicize by other means) concerning the establishment, condition, or change in any component (facility, service, or procedure of, or hazard in the National Airspace System) the timely knowledge of which is essential to personnel concerned with flight operations.

1. NOTAM(D)—A NOTAM given (in addition to local dissemination) distant dissemination via teletypewriter beyond the area of responsibility of the Flight Service Station. These NOTAM's will be stored and repeated hourly until canceled.
2. NOTAM(L)—A NOTAM given local dissemination by voice (teletypewriter where applicable) and a wide variety of means, such as telautograph, teleprinter, facsimile reproduction, hot line, telecopier, telegraph, and telephone, to satisfy local user requirements.
3. FDC NOTAM—A notice to airmen, regulatory in nature, transmitted by NFDC and given all-circuit dissemination.

ICAO—NOTAM— A notice, containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations.

NUMEROUS TARGETS VICINITY (LOCATION)— A traffic advisory issued by ATC to advise pilots that targets on the radar scope are too numerous to issue individually. (See Traffic Advisories)

OBSTACLE— An existing object, object of natural growth, or terrain at a fixed geographical location or which may be expected at a fixed location within a prescribed area with reference to which vertical clearance is or must be provided during flight operation.

OBSTRUCTION— Any object/obstacle exceeding the obstruction standards specified by FAR Part 77, Subpart C.

OBSTRUCTION LIGHT— A light or one of a group of lights, usually red or white, frequently mounted on a surface structure or natural terrain to warn pilots of the presence of an obstruction.

OFF-ROUTE VECTOR— A vector by ATC which takes an aircraft off a previously assigned route. Altitudes assigned by ATC during such vectors provide required obstacle clearance.

OFFSET PARALLEL RUNWAYS— Staggered runways having centerlines which are parallel.

ON COURSE—

1. Used to indicate that an aircraft is established on the route centerline.
2. Used by ATC to advise a pilot making a radar approach that his aircraft is lined up on the final approach course. (See On-Course Indication)

ON-COURSE INDICATION— An indication on an instrument, which provides the pilot a visual means of determining that the aircraft is located on the centerline of a given navigational track, or an indication on a radar scope that an aircraft is on a given track.

OPTION APPROACH— An approach requested and conducted by a pilot which will result in either a touch-and-go, missed approach, low approach, stop-and-go, or full stop landing. (See Cleared for the Option) (Refer to AIM)

ORGANIZED TRACK SYSTEM— A moveable system of oceanic tracks that traverses the North Atlantic between Europe and North America the physical position of which is determined twice daily taking the best advantage of the winds aloft.

OUT— The conversation is ended and no response is expected.

OUTER AREA (associated with ARSA)— Nonregulatory airspace surrounding designated ARSA airports wherein ATC provides radar vectoring and sequencing on a full-time basis for all IFR and participating VFR aircraft. The service provided in the outer area is called ARSA service which includes: IFR/IFR—standard IFR separation; IFR/VFR—traffic advisories and conflict resolution; and VFR/VFR—traffic advisories and, as appropriate, safety alerts. The normal radius will be 20 nautical miles with some variations based on site-specific requirements. The outer area extends outward from the primary ARSA airport and extends from the lower limits of radar/radio coverage up to the ceiling of the approach control's delegated airspace excluding the ARSA and other airspace as appropriate. (See Controlled Airspace—Airport Radar Service Area / ARSA, Conflict Resolution)

OUTER COMPASS LOCATOR— (See Compass Locator)

OUTER FIX— A general term used within ATC to describe fixes in the terminal area, other than the final approach fix. Aircraft are normally cleared to these fixes by an Air Route Traffic Control Center or an Approach Control Facility. Aircraft are normally cleared from these fixes to the final approach fix or final approach course.

OUTER MARKER/OM— A marker beacon at or near the glide slope intercept altitude of an ILS approach. It is keyed to transmit two dashes per second on a 400 Hz tone, which is received aurally and visually by compatible airborne equipment. The OM is normally located four to seven miles from the runway threshold on the extended centerline of the runway. (See Marker Beacon, Instrument Landing System) (Refer to AIM)

OVER— My transmission is ended; I expect a response.

OVERHEAD APPROACH/360 OVERHEAD— A series of predetermined maneuvers prescribed for VFR arrival of military aircraft (often in formation) for entry into the VFR traffic pattern and to proceed to a landing. The pattern usually specifies the following:

1. The radio contact required of the pilot.
2. The speed to be maintained.
3. An initial approach 3 to 5 miles in length.
4. An elliptical pattern consisting of two 180 degree turns.
5. A break point at which the first 180 degree turn is started.
6. The direction of turns.
7. Altitude (at least 500 feet above the conventional pattern).
8. A "Roll-out" on final approach not less than 1/4 mile from the landing threshold and not less than 300 feet above the ground.

PAN-PAN— The international radio-telephony urgency signal. When repeated three times, indicates uncertainty or alert followed by nature of urgency. (See MAYDAY) (Refer to AIM)

PARALLEL ILS/MLS APPROACHES— Approaches to parallel runways by IFR aircraft which, when established inbound toward the airport on the adjacent final approach courses, are radar-separated by at least 2 miles. (See Final Approach Course, Simultaneous ILS/MLS Approaches).

PARALLEL OFFSET ROUTE— A parallel track to the left or right of the designated or established airway/route. Normally associated with Area Navigation (RNAV) operations. (See Area Navigation)

PARALLEL RUNWAYS— Two or more runways at the same airport whose centerlines are parallel. In addition to runway number, parallel runways are designated as L (left) and R (right) or, if three parallel runways exist, L (left), C (center), and R (right).

PERMANENT ECHO— Radar signals reflected from fixed objects on the earth's surface; e.g., buildings, towers, terrain. Permanent echoes are distinguished from "ground clutter' by being definable locations rather than large areas. Under certain conditions they may be used to check radar alignment.

PHOTO RECONNAISSANCE (PR)— Military activity that requires locating individual photo targets and navigating to the targets at a preplanned angle and altitude. The activity normally requires a lateral route width of 16NM and altitude range of 1,500 feet to 10,000 feet AGL.

PILOT BRIEFING/PRE-FLIGHT PILOT BRIEFING— A service provided by the FSS to assist pilots in flight planning. Briefing items may include weather information, NOTAMS, military activities, flow control information, and other items as requested. (Refer to AIM)

PILOT IN COMMAND— The pilot responsible for the operation and safety of an aircraft during flight time. (Refer to FAR Part 91)

PILOTS AUTOMATIC TELEPHONE WEATHER ANSWERING SERVICE/PATWAS— A continuous telephone recording containing current and forecast weather information for pilots. (See Flight Service Station) (Refer to AIM)

PILOT'S DISCRETION— When used in conjunction with altitude assignments, means that ATC has offered the pilot the option of starting climb or descent whenever he wishes and conducting the climb or descent at any rate he wishes. He may temporarily level off at any intermediate altitude. However, once he has vacated an altitude, he may not return to that altitude.

PILOT WEATHER REPORT/PIREP— A report of meteorological phenomena encountered by aircraft in flight. (Refer to AIM)

POSITION REPORT/PROGRESS REPORT— A report over a known location as transmitted by an aircraft to ATC. (Refer to AIM)

POSITION SYMBOL— A computer-generated indication shown on a radar display to indicate the mode of tracking.

POSITIVE CONTROL— The separation of all air traffic within designated airspace by air traffic control. (See Positive Control Area)

POSITIVE CONTROL AREA/PCA— (See Controlled Airspace)

PRACTICE INSTRUMENT APPROACH— An instrument approach procedure conducted by a VFR or an IFR aircraft for the purpose of pilot training or proficiency demonstrations.

PRECIPITATION— Any or all forms of water particles (rain, sleet, hail, or snow) that fall from the atmosphere and reach the surface.

PRECISION APPROACH PROCEDURE/PRECISION APPROACH— A standard instrument approach procedure in which an electronic glideslope/glidepath is provided; e.g., ILS/MLS and PAR. (See Instrument Landing System, Microwave Landing System, Precision Approach Radar)

PRECISION APPROACH RADAR/PAR— Radar equipment in some ATC facilities operated by the FAA and/or the military services at joint-use civil/military locations and separate military installations to detect and display azimuth, elevation, and range of aircraft on the final approach course to a runway. This equipment may be used to monitor certain nonradar approaches, but is primarily used to conduct a precision instrument approach (PAR) wherein the controller issues guidance instructions to the pilot based on the aircraft's position in relation to the final approach course (azimuth), the glidepath (elevation), and the distance (range) from the touchdown point on the runway as displayed on the radar scope. (See Glidepath, PAR) (Refer to AIM)

The abbreviation "PAR" is also used to denote preferential arrival routes in ARTCC computers. (See Preferential Routes)

ICAO-PRECISION APPROACH RADAR/PAR—Primary radar equipment used to determine the position of an aircraft during final approach, in terms of lateral and vertical deviations relative to a nominal approach path, and in range relative to touchdown.

PREFERENTIAL ROUTES— Preferential routes (PDR's, PAR's, and PDAR's) are adapted in ARTCC computers to accomplish inter/intrafacility controller coordination and to assure that flight data is posted at the proper control positions. Locations having a need for these specific inbound and outbound routes normally publish such routes in local facility bulletins, and their use by pilots minimizes flight plan route amendments. When the workload or traffic situation permits, controllers normally provide radar vectors or assign requested routes to minimize circuitous routing. Preferential routes are usually confined to one ARTCC's area and are referred to by the following names or acronyms:

1. Preferential Departure Route/PDR—A specific departure route from an airport or terminal area to an en route point where there is no further need for flow control. It may be included in a Standard Instrument Departure (SID) or a Preferred IFR Route.
2. Preferential Arrival Route/PAR—A specific arrival route from an appropriate en route point to an airport or terminal area. It may be included in a Standard Terminal Arrival (STAR) or a Preferred IFR Route. The abbreviation "PAR" is used primarily within the ARTCC and should not be confused with the abbreviation for Precision Approach Radar.
3. Preferential Departure and Arrival Route/PDAR—A route between two terminals which are within or immediately adjacent to one ARTCC's area. PDAR's are not synonomous with Preferred IFR Routes but may be listed as such as they do accomplish essentially the same purpose. (See Preferred IFR Routes, NAS Stage A)

PREFERRED IFR ROUTES— Routes established between busier airports to increase system efficiency and capacity. They normally extend through one or more ARTCC areas and are designed to achieve balanced traffic flows among high density terminals. IFR clearances are issued on the basis of these routes except when severe weather avoidance procedures or other factors dictate otherwise. Preferred IFR Routes are listed in the Airport/Facility Directory. If a flight is planned to or from an area having such routes but the departure or arrival point is not listed in the Airport/Facility Directory, pilots may use that part of a Preferred IFR Route which is appropriate for the departure or arrival point that is listed. Preferred IFR Routes are correlated with SID's and STAR's and may be defined by airways, jet routes, direct routes between NAVAID's, Waypoints, NAVAID radials/DME, or any combinations thereof. (See Standard Instrument Departure, Standard Terminal Arrival, Preferential Routes, Center's Area) (Refer to Airport/Facility Directory and Notices to Airmen Publication)

PREVAILING VISIBILITY— (See Visibility)

PROCEDURE TURN INBOUND— That point of a procedure turn maneuver where course reversal has been completed and an aircraft is established inbound on the intermediate approach segment or final approach course. A report of "procedure turn inbound" is normally used by ATC as a position report for separation purposes. (See Final Approach Course, Procedure Turn, Segments of an Instrument Approach Procedure)

PROCEDURE TURN/PT— The maneuver prescribed when it is necessary to reverse direction to establish an aircraft on the intermediate approach segment or final approach course. The outbound course, direction of turn, distance within which the turn must be completed, and minimum altitude are specified in the procedure. However, unless otherwise restricted, the point at which the turn may be commenced and the type and rate of turn are left to the discretion of the pilot.

ICAO—PROCEDURE TURN— A maneuver in which a turn is made away from a designated track followed by a turn in the opposite direction, both turns being executed so as to permit the aircraft to intercept and proceed along the reciprocal of the designated track.

PROFILE DESCENT— An uninterrupted descent (except where level flight is required for speed adjustment; e.g., 250 knots at 10,000 feet MSL) from cruising altitude/level to interception of a glide slope or to a minimum altitude specified for the initial or intermediate approach segment of a nonprecision instrument approach. The profile descent normally terminates at the approach gate or where the glide slope or other appropriate minimum altitude is intercepted.

PROGRAMMABLE INDICATOR DATA PROCESSOR/PIDP— The PIDP is a modification to the AN/TPX-42 interrogator system currently installed in fixed RAPCON's. The PIDP detects, tracks, and predicts secondary radar aircraft targets. These are displayed by means of computer-generated symbols and alphanumeric characters depicting flight identification, aircraft altitude, ground speed, and flight plan data. Although primary radar targets are not tracked, they are displayed coincident with the secondary radar targets as well as with the other symbols and alphanumerics. The system has the capability of interfacing with ARTCC's.

PROHIBITED AREA— (See Special Use Airspace).

ICAO—PROHIBITED AREA— An airspace of defined dimensions, above the land areas or territorial waters of a State, within which the flight of aircraft is prohibited.

PROPOSED BOUNDARY CROSSING TIME/PBCT— Each center has a PBCT parameter for each internal airport. Proposed internal flight plans are transmitted to the adjacent center if the flight time along the proposed route from the departure airport to the center boundary is less than or equal to the value of PBCT or if airport adaptation specifies transmission regardless of PBCT.

PUBLISHED ROUTE— A route for which an IFR altitude has been established and published; e.g., Federal Airways, Jet Routes, Area Navigation Routes, Specified Direct Routes.

QUADRANT— A quarter part of a circle, centered on a NAVAID, oriented clockwise from magnetic north as follows: NE quadrant 000-089, SE quadrant 090-179, SW quadrant 180-269, NW quadrant 270-359.

QUICK LOOK— A feature of NAS Stage A and ARTS which provides the controller the capability to display full data blocks of tracked aircraft from other control positions.

QUOTA FLOW CONTROL/QFLOW— A flow control procedure by which the Central Flow Control Function (CFCF) restricts traffic to the ARTC Center area having an impacted airport, thereby avoiding sector/area saturation. (See Air Traffic Control Systems ommand Center) (Refer to Airport/Facility Directory)

RADAR/RADIO DETECTION AND RANGING— A device which, by measuring the time interval between transmission and reception of radio pulses and correlating the angular orientation of the radiated antenna beam or beams in azimuth and/or elevation, provides information on range, azimuth, and/or elevation of objects in the path of the transmitted pulses.

1. Primary Radar—A radar system in which a minute portion of a radio pulse transmitted from a site is reflected by an object and then received back at that site for processing and display at an air traffic control facility.
2. Secondary Radar/Radar Beacon/ATCRBS—A radar system in which the object to be detected is fitted with cooperative equipment in the form of a radio receiver/transmitter (transponder). Radar pulses transmitted from the searching transmitter/receiver (interrogator) site are received in the cooperative equipment and used to trigger a distinctive transmission from the transponder. This reply transmission, rather than a reflected signal, is then received back at the transmitter/receiver site for processing and display at an air traffic control facility. (See Transponder, Interrogator) (Refer to AIM)

ICAO—RADAR— A radio detection device which provides information on range, azimuth, and/or elevation of objects.

1. Primary Radar—A radar system which uses reflected radio signals.
2. Secondary Radar—A radar system wherein a radio signal transmitted from a radar station initiates the transmission of a radio signal from another station.

RADAR ADVISORY— The provision of advice and information based on radar observations. (See Advisory Service)

RADAR APPROACH— An instrument approach procedure which utilizes Precision Approach Radar (PAR) or Airport Surveillance Radar (ASR). (See PAR Approach, Surveillance Approach, Airport Surveillance Radar, Precision Approach Radar, Instrument Approach Procedure) (Refer to AIM)

ICAO—RADAR APPROACH— An approach, executed by an aircraft, under the direction of a radar controller.

RADAR APPROACH CONTROL FACILITY— A terminal ATC facility that uses radar and nonradar capabilities to provide approach control services to aircraft arriving, departing, or transiting airspace controlled by the facility (see Approach Control Service). Provides radar ATC services to aircraft operating in the vicinity of one or more civil and/ or military airports in a terminal area. The facility may provide services of a ground controlled approach (GCA); i.e., ASR and PAR approaches. A radar approach control facility may be operated by FAA, USAF, US Army, USN, USMC, or jointly by FAA and a military service. Specific facility nomenclatures are used for administrative purposes only and are related to the physical location of the facility and the operating service generally as follows:

> Army Radar Approach Control/ARAC (Army).
>
> Radar Air Traffic Control Facility/ RATCF (Navy/FAA).
>
> Radar Approach Control/RAPCON (Air Force/FAA).
>
> Terminal Radar Approach Control/TRACON (FAA).

Tower/Airport Traffic Control Tower/ATCT (FAA). (Only those towers delegated approach control authority.)

RADAR ARRIVAL— An arriving aircraft which is being vectored to the final approach course for an instrument approach or toward the airport for a visual approach. (See Radar Approach, Visual Approach)

RADAR BEACON— (See Radar)

RADAR CONTACT—

1. Used by ATC to inform an aircraft that it is identified on the radar display and radar flight following will be provided until radar identification is terminated. Radar service may also be provided within the limits of necessity and capability. When a pilot is informed of "radar contact," he automatically discontinues reporting over compulsory reporting points. (See Radar Flight Following, Radar Contact Lost, Radar Service, Radar Service Terminated). (Refer to AIM)
2. The term used to inform the controller that the aircraft is identified and approval is granted for the aircraft to enter the receiving controllers airspace.

ICAO—RADAR CONTACT— The situation which exists when the radar blip of a particular aircraft is seen and identified on a radar display.

RADAR CONTACT LOST— Used by ATC to inform a pilot that radar identification of his aircraft has been lost. The loss may be attributed to several things including the aircraft's merging with weather or ground clutter, the aircraft's flying below radar line of sight, the aircraft's entering an area of poor radar return, or a failure of the aircraft transponder or the ground radar equipment. (See Clutter, Radar Contact)

RADAR ENVIRONMENT— An area in which radar service may be provided. (See Radar Contact, Radar Service, Additional Services, Traffic Advisories)

RADAR FLIGHT FOLLOWING— The observation of the progress of radar identified aircraft, whose primary navigation is being provided by the pilot, wherein the controller retains and correlates the aircraft identity with the appropriate target or target symbol displayed on the radar scope. (See Radar Contact, Radar Service) (Refer to AIM)

RADAR IDENTIFICATION— The process of ascertaining that an observed radar target is the radar return from a particular aircraft. (See Radar Contact, Radar Service)

*ICAO—RADAR IDENTIFICATION—*The process of correlating a particular radar blip with a specific aircraft.

RADAR IDENTIFIED AIRCRAFT— An aircraft, the position of which has been correlated with an observed target or symbol on the radar display. (See Radar Contract, Radar Contact Lost)

RADAR MONITORING— (See Radar Service)

RADAR NAVIGATIONAL GUIDANCE— (See Radar Service)

RADAR POINT OUT/POINT OUT— Used between controllers to indicate radar handoff action where the initiating controller plans to retain communications with an aircraft penetrating the other controller's airspace and additional coordination is required.

RADAR ROUTE— A flight path or route over which an aircraft is vectored. Navigational guidance and altitude assignments are provided by ATC. (See Flight Path, Route)

RADAR SEPARATION— (See Radar Service)

RADAR SERVICE— A term which encompasses one or more of the following services based on the use of radar which can be provided by a controller to a pilot of a radar identified aircraft.

1. Radar Separation.—Radar spacing of aircraft in accordance with established minima.

ICAO—RADAR SEPARATION— The separation used when aircraft position information is derived from radar sources.

2. Radar Navigational Guidance.—Vectoring aircraft to provide course guidance.
3. Radar Monitoring.—The radar flight-following of aircraft, whose primary navigation is being performed by the pilot, to observe and note deviations from its authorized flight path, airway, or route. When being applied specifically to radar monitoring of instrument approaches; i.e., with precision approach radar (PAR) or radar monitoring of simultaneous ILS/MLS approaches, it includes advice and instructions whenever an aircraft nears or exceeds the prescribed PAR safety limit or simultaneous ILS/MLS no transgression zone. (See Additional Services, Traffic Advisories)

ICAO—RADAR MONITORING— The use of radar for the purpose of providing aircraft with information and advice relative to significant deviations from nominal flight path.

ICAO—RADAR SERVICE— Term used to indicate a service provided directly by means of radar.

RADAR SERVICE TERMINATED— Used by ATC to inform a pilot that he will no longer be provided any of the services that could be received while in radar contact. Radar service is automatically terminated, and the pilot is not advised in the following cases:

1. An aircraft cancels its IFR flight plan, except within a TCA, TRSA, ARSA, or where Stage II service is provided.
2. An aircraft conducting an instrument, visual, or contact approach has landed or has been instructed to change to advisory frequency.
3. An arriving VFR aircraft, receiving radar service to a tower-controlled airport within a TCA, TRSA, ARSA, or where Stage II service is provided, has landed; or to all other airports, is instructed to change to tower or advisory frequency.
4. An aircraft completes a radar approach.

RADAR SURVEILLANCE— The radar observation of a given geographical area for the purpose of performing some radar function.

RADAR TRAFFIC ADVISORIES— (See Traffic Advisories)

RADAR TRAFFIC INFORMATION SERVICE— (See Traffic Advisories)

RADAR WEATHER ECHO INTENSITY LEVELS— Existing radar systems cannot detect turbulence. However, there is a direct correlation between the degree of turbulence and other weather features associated with thunderstorms and the radar weather echo intensity. The National Weather Service has categorized six (6) levels of radar weather echo intensity. The following list gives the weather features likely to be associated with these levels during thunderstorm weather situations:

1. Level 1 (WEAK) and Level 2 (MODERATE). Light to moderate turbulence is possible with lightning.
2. Level 3 (STRONG). Severe turbulence possible, lightning.
3. Level 4 (VERY STRONG). Severe turbulence likely, lightning.
4. Level 5 (INTENSE). Severe turbulence, lightning, organized wind gusts. Hail likely.
5. Level 6 (EXTREME). Severe turbulence, large hail, lightning, extensive wind gusts, and turbulence.

RADIAL— A magnetic bearing extending from a VOR/VORTAC/TACAN navigation facility.

RADIO—

1. A device used for communication.
2. Used to refer to a flight service station; e.g., "Seattle Radio" is used to call Seattle FSS.

RADIO ALTIMETER/RADAR ALTIMETER— Aircraft equipment which makes use of the reflection of radio waves from the ground to determine the height of the aircraft above the surface.

RADIO BEACON— (See Nondirectional Beacon)

RADIO MAGNETIC INDICATOR/RMI— An aircraft navigational instrument coupled with a gyro compass or similar compass that indicates the direction of a selected NAVAID and indicates bearing with respect to the heading of the aircraft.

RAMP— (See Apron)

READ BACK— Repeat my message back to me.

RECEIVING CONTROLLER/FACILITY— A controller/facility receiving control of an aircraft from another controller/facility.

REDUCE SPEED TO (SPEED)— (See Speed Adjustment)

RELEASE TIME— A departure time restriction issued to a pilot by ATC when necessary to separate a departing aircraft from other traffic.

*ICAO—RELEASE TIME—*Time prior to which an aircraft should be given further clearance or prior to which it should not proceed in case of radio failure.

REMOTE COMMUNICATIONS AIR/GROUND FACILITY/RCAG— An unmanned VHF/UHF transmitter/receiver facility which is used to expand ARTCC air/ground communications coverage and to facilitate direct contact between pilots and controllers. RCAG facilities are sometimes not equipped with emergency frequencies 121.5 MHz and 243.0 MHz. (Refer to AIM)

REMOTE COMMUNICATIONS OUTLET/RCO AND REMOTE TRANSMITTER/RECEIVER/RTR— An unmanned communications facility remotely controlled by air traffic personnel. RCO's serve FSS's. RTR's serve terminal ATC facilities. An RCO or RTR may be UHF or VHF and will extend the communication range of the air traffic facility. There are several classes of RCO's and RTR's. The class is determined by the number of transmitters or receivers. Classes A through G are used primarily for air/ground purposes. RCO and RTR class O facilities are nonprotected outlets subject to undetected and prolonged outages. RCO (O's) and RTR (O's) were established for the express purpose of providing ground-to-ground communications between air traffic control specialists and pilots located at a satellite airport for delivering en route clearances, issuing departure authorizations, and acknowledging instrument flight rules cancellations or departure/landing times. As a secondary function, they may be used for advisory purposes whenever the aircraft is below the coverage of the primary air/ground frequency.

REMOTE TRANSMITTER/RECEIVER/RTR— (See Remote Communications Outlet)

REPORT— Used to instruct pilots to advise ATC of specified information; e.g., "Report passing Hamilton VOR."

REPORTING POINT— A geographical location in relation to which the position of an aircraft is reported. (See Compulsory Reporting Point) (Refer to AIM)

ICAO—REPORTING POINT— A specified geographical location in relation to which the position of an aircraft can be reported.

REQUEST FULL ROUTE CLEARANCE/FRC— Used by pilots to request that the entire route of flight be read verbatim in an ATC clearance. Such request should be made to preclude receiving an ATC clearance based on the original filed flight plan when a filed IFR flight plan has been revised by the pilot, company, or operations prior to departure.

RESCUE COORDINATION CENTER/RCC— A search and rescue (SAR) facility equipped and manned to coordinate and control SAR operations in an area designated by the SAR plan. The U.S. Coast Guard and the U.S. Air Force have responsibility for the operation of RCC's.

ICAO—RESCUE CO-ORDINATION CENTRE— A unit responsible for promoting efficient organization of search and rescue service and for co-ordinating the conduct of search and rescue operations within a search and rescue region.

RESTRICTED AREA— (See Special Use Airspace).

*ICAO—RESTRICTED AREA—*Airspace of defined dimensions, above the land areas or territorial waters of a State, within which the flight of aircraft is restricted in accordance with certain specified conditions.

RESUME OWN NAVIGATION— Used by ATC to advise a pilot to resume his own navigational responsibility. It is issued after completion of a radar vector or when radar contact is lost while the aircraft is being radar vectored. (See Radar Contact Lost, Radar Service Terminated)

RNAV— (See Area Navigation)

RNAV APPROACH— An instrument approach procedure which relies on aircraft area navigation equipment for navigational guidance. (See Instrument Approach Procedure, Area Navigation)

ROAD RECONNAISSANCE (RC)— Military activity requiring navigation along roads, railroads, and rivers. Reconnaissance route/route segments are seldom along a straight line and normally require a lateral route width of 10NM to 30NM and an altitude range of 500 feet to 10,000 feet AGL.

ROGER— I have received all of your last transmission. It should not be used to answer a question requiring a yes or a no answer. (See Affirmative, Negative)

ROLLOUT RVR— (See Visibility)

ROUTE— A defined path, consisting of one or more courses in a horizontal plane, which aircraft traverse over the surface of the earth. (See Airway, Jet Route, Published Route, Unpublished Route)

ROUTE SEGMENT— As used in Air Traffic Control, a part of a route that can be defined by two navigational fixes, two NAVAID's, or a fix and a NAVAID. (See Fix, Route)

*ICAO—ROUTE SEGMENT—*A portion of a route to be flown, as defined by two consecutive significant points specified in a flight plan.

RUNWAY— A defined rectangular area on a land airport prepared for the landing and takeoff run of aircraft along its length. Runways are normally numbered in relation to their magnetic direction rounded off to the nearest 10 degrees; e.g., Runway 01, Runway 25. (See Parallel Runways)

*ICAO—RUNWAY—*A defined rectangular area, on a land aerodrome prepared for the landing and takeoff run of aircraft along its length.

RUNWAY CENTERLINE LIGHTING— (See Airport Lighting)

RUNWAY CONDITION READING/RCR— Numerical decelerometer readings relayed by air traffic controllers at USAF and certain civil bases for use by the pilot in determining runway braking action. These readings are routinely relayed only to USAF and Air National Guard Aircraft. (See Braking Action)

RUNWAY END IDENTIFIER LIGHTS— (See Airport Lighting)

RUNWAY GRADIENT— The average slope, measured in percent, between two ends or points on a runway. Runway gradient is depicted on Government aerodrome sketches when total runway gradient exceeds 0.3%.

RUNWAY HEADING— The magnetic direction indicated by the runway number. When cleared to "fly/maintain runway heading," pilots are expected to comply with the ATC clearance by flying the heading indicated by the runway number without applying any drift correction; e.g., Runway 4, 040° magnetic heading; Runway 20, 200° magnetic heading.

RUNWAY IN USE/ACTIVE RUNWAY/DUTY RUNWAY— Any runway or runways currently being used for takeoff or landing. When multiple runways are used, they are all considered active runways.

RUNWAY LIGHTS— (See Airport Lighting)

RUNWAY MARKINGS— (See Airport Marking Aids.)

RUNWAY PROFILE DESCENT— An instrument flight rules (IFR) air traffic control arrival procedure to a runway published for pilot use in graphic and/or textual form and may be associated with a STAR. Runway Profile Descents provide routing and may depict crossing altitudes, speed restrictions, and headings to be flown from the en route structure to the point where the pilot will receive clearance for and execute an instrument approach procedure. A Runway Profile Descent may apply to more than one runway if so stated on the chart. (Refer to AIM)

RUNWAY USE PROGRAM— A noise abatement runway selection plan designed to enhance noise abatement efforts with regard to airport communities for arriving and departing aircraft. These plans are developed into runway use programs and apply to all turbojet aircraft 12,500 pounds or heavier; turbojet aircraft less than 12,500 pounds are included only if the airport proprietor determines that the aircraft creates a noise problem. Runway use programs are coordinated with FAA offices, and safety criteria used in these programs are developed by the Office of Flight Operations. Runway use programs are administered by the Air Traffic Service as "Formal" or "Informal" programs.

1. Formal Runway Use Program—An approved noise abatement program which is defined and acknowledged in a Letter of Understanding between Flight Operations, Air Traffic Service, the airport proprietor, and the users. Once established, participation in the program is mandatory for aircraft operators and pilots as provided for in FAR 91.87.
2. Informal Runway Use Program—An approved noise abatement program which does not require a Letter of Understanding, and participation in the program is voluntary for aircraft operators/pilots.

RUNWAY VISIBILITY VALUE— (See Visibility)

RUNWAY VISUAL RANGE— (See Visibility)

SAFETY ALERT— A safety alert issued by ATC to aircraft under their control if ATC is aware the aircraft is at an altitude which, in the controller's judgment, places the aircraft in unsafe proximity to terrain, obstructions, or other aircraft. The controller may discontinue the issuance of further alerts if the pilot advises he is taking action to correct the situation or has the other aircraft in sight.

1. Terrain/Obstruction Alert—A safety alert issued by ATC to aircraft under their control if ATC is aware the aircraft is at an altitude which, in the controller's judgment, places the aircraft in unsafe proximity to terrain/obstructions; e.g., "Low Altitude Alert, check your altitude immediately."
2. Aircraft Conflict Alert—A safety alert issued by ATC to aircraft under their control if ATC is aware of an aircraft that is not under their control at an altitude which, in the controller's judgment, places both aircraft in unsafe proximity to each other. With the alert, ATC will offer the pilot an alternate course of action when feasible; e.g., "Traffic Alert, advise you turn right heading zero niner zero or climb to eight thousand immediately."

The issuance of a safety alert is contingent upon the capability of the controller to have an awareness of an unsafe condition. The course of action provided will be predicated on other traffic under ATC control. Once the alert is issued, it is solely the pilot's prerogative to determine what course of action, if any, he will take.

SAIL BACK— A maneuver during high wind conditions (usually with power off) where float plane movement is controlled by water rudders/opening and closing cabin doors.

SAY AGAIN— Used to request a repeat of the last transmission. Usually specifies transmission or portion thereof not understood or received; e.g., "Say again all after ABRAM VOR."

SAY ALTITUDE— Used by ATC to ascertain an aircraft's specific altitude/flight level. When the aircraft is climbing or descending, the pilot should state the indicated altitude rounded to the nearest 100 feet.

SAY HEADING— Used by ATC to request an aircraft heading. The pilot should state the actual heading of the aircraft.

SEA LANE— A designated portion of water outlined by visual surface markers for and intended to be used by aircraft designed to operate on water.

SEARCH AND RESCUE FACILITY— A facility responsible for maintaining and operating a search and rescue (SAR) service to render aid to persons and property in distress. It is any SAR unit, station, NET, or other operational activity which can be usefully employed during an SAR Mission; e.g., a Civil Air Patrol Wing, or a Coast Guard Station. (See Search and Rescue)

SEARCH AND RESCUE/SAR— A service which seeks missing aircraft and assists those found to be in need of assistance. It is a cooperative effort using the facilities and services of available Federal, state and local agencies. The U.S. Coast Guard is responsible for coordination of search and rescue for the Maritime Region, and the U.S. Air Force is responsible for search and rescue for the Inland Region. Information pertinent to search and rescue should be passed through any air traffic facility or be transmitted directly to the Rescue Coordination Center by telephone. (See Flight Service Station, Rescue Coordination Center) (Refer to AIM)

SEE AND AVOID— A visual procedure wherein pilots of aircraft flying in visual meteorological conditions (VMC), regardless of type of flight plan, are charged with the responsibility to observe the presence of other aircraft and to maneuver their aircraft as required to avoid the other aircraft. Right-of-way rules are contained in FAR, Part 91. (See Instrument Flight Rules, Visual Flight Rules, Visual Meteorological Conditions, Instrument Meteorological Conditions)

SEGMENTED CIRCLE— A system of visual indicators designed to provide traffic pattern information at airports without operating control towers. (Refer to AIM)

SEGMENTS OF AN INSTRUMENT APPROACH PROCEDURE— An instrument approach procedure may have as many as four separate segments depending on how the approach procedure is structured.

1. Initial Approach—The segment between the initial approach fix and the intermediate fix or the point where the aircraft is established on the intermediate course or final approach course.
2. Intermediate Approach—The segment between the intermediate fix or point and the final approach fix.
3. Final Approach—The segment between the final approach fix or point and the runway, airport, or missed approach point.
4. Missed Approach—The segment between the missed approach point or the point of arrival at decision height and the missed approach fix at the prescribed altitude. (Refer to FAR, Part 97)

ICAO

1. *Initial Approach*—That part of an instrument approach procedure consisting of the first approach to the first navigational facility associated with the procedure, or to a predetermined fix.
2. *Intermediate Approach*—That part of an instrument approach procedure from the first arrival at the first navigational facility or predetermined fix, to the beginning of the final approach.
3. *Final Approach*—That part of an instrument approach procedure from the time the aircraft has:
    a. Completed the last procedure turn or base turn where one is specified, or
    b. Crossed a specified fix, or
    c. Intercepted the last track specified for the procedures until it has crossed a point in the vicinity of an aerodrome from which:
    (1) A landing can be made, or
    (2) A missed approach procedure is initiated.

4. *Missed Approach Procedure*—The procedure to be followed if, after an instrument approach, a landing is not effected and occurring normally:
   a. When the aircraft has descended to the decision height and has not established visual contact, or
   b. When directed by air traffic control to pull up or to go around again.

SEPARATION— In air traffic control, the spacing of aircraft to achieve their safe and orderly movement in flight and while landing and taking off. (See Separation Minima)

ICAO—SEPARATION—Spacing between aircraft, levels or tracks.

SEPARATION MINIMA— The minimum longitudinal, lateral, or vertical distances by which aircraft are spaced through the application of air traffic control procedures. (See Separation)

SEVERE WEATHER AVOIDANCE PLAN/SWAP— An approved plan to minimize the affect of severe weather on traffic flows in impacted terminal and/or ARTCC areas. SWAP is normally implemented to provide the least disruption to the ATC system when flight through portions of airspace is difficult or impossible due to severe weather.

SHORT RANGE CLEARANCE— A clearance issued to a departing IFR flight which authorizes IFR flight to a specific fix short of the destination while air traffic control facilities are coordinating and obtaining the complete clearance.

SHORT TAKEOFF AND LANDING AIRCRAFT/ STOL AIRCRAFT— An aircraft which, at some weight within its approved operating weight, is capable of operating from a STOL runway in compliance with the applicable STOL characteristics, airworthiness, operations, noise, and pollution standards. (See Vertical Takeoff and Landing Aircraft)

SIDESTEP MANEUVER— A visual maneuver accomplished by a pilot at the completion of an instrument approach to permit a straight-in landing on a parallel runway not more than 1,200 feet to either side of the runway to which the instrument approach was conducted. (Refer to AIM)

***SIGMET* /WS/SIGNIFICANT METEOROLOGICAL INFORMATION—** A weather advisory issued concerning weather significant to the safety of all aircraft. SIGMET advisories cover severe and extreme turbulence, severe icing, and widespread dust or sandstorms that reduce visibility to less than 3 miles. (See AIRMET and Convective SIGMET) (Refer to AIM).

ICAO—SIGMET INFORMATION— Information prepared by a meteorological watch office regarding the occurrence or expected occurrence of one or more of the following phenomena:

1. At subsonic cruising levels:

   Active thunderstorm area.
   Tropical revolving storm.
   Severe line squall.
   Heavy hail.
   Severe turbulence.
   Severe icing.
   Marked mountain waves.
   Widespread sandstorm/duststorm.

2. At transonic levels and supersonic cruising levels:

   Moderate or severe turbulence.
   Cumulonimbus clouds.
   Hail.

SIMPLIFIED DIRECTIONAL FACILITY/SDF— A NAVAID used for nonprecision instrument approaches. The final approach course is similar to that of an ILS localizer except that the SDF course may be offset from the runway, generally not more than 3 degrees, and the course may be wider than the localizer, resulting in a lower degree of accuracy. (Refer to AIM)

SIMULATED FLAMEOUT/SFO— A practice approach by a jet aircraft (normally military) at idle thrust to a runway. The approach may start at a relatively high altitude over a runway (high key) and may continue on a relatively high and wide downwind leg with a high rate of descent and a continuous turn to final. It terminates in a landing or low approach. The purpose of this approach is to simulate a flameout. (See Flameout)

SIMULTANEOUS ILS/MLS APPROACHES— An approach system permitting simultaneous ILS/MLS approaches to airports having parallel runways separated by at least 4,300 feet between centerlines. Integral parts of a total system are ILS/MLS, radar, communications, ATC procedures, and appropriate airborne equipment. (See Parallel Runways) (Refer to AIM)

SINGLE DIRECTION ROUTES— Preferred IFR Routes which are sometimes depicted on high altitude en route charts and which are normally flown in one direction only. (See Preferred IFR Route) (Refer to Airport/Facility Directory)

SINGLE FREQUENCY APPROACH/SFA— A service provided under a letter of agreement to military single-piloted turbojet aircraft which permits use of a single UHF frequency during approach for landing. Pilots will not normally be required to change frequency from the beginning of the approach to touchdown except that pilots conducting an en route descent are required to change frequency when control is transferred from the air route traffic control center to the terminal facility. The abbreviation "SFA" in the DOD FLIP IFR Supplement under "Communications" indicates this service is available at an aerodrome.

SINGLE-PILOTED AIRCRAFT— A military turbojet aircraft possessing one set of flight controls, tandem cockpits, or two sets of flight controls but operated by one pilot is considered single-piloted by ATC when determining the appropriate air traffic service to be applied. (See Single Frequency Approach)

SLASH— A radar beacon reply displayed as an elongated target.

SLOW TAXI— To taxi a float plane at low power or low RPM.

SPEAK SLOWER— Used in verbal communications as a request to reduce speech rate.

SPECIAL EMERGENCY— A condition of air piracy or other hostile act by a person(s) aboard an aircraft which threatens the safety of the aircraft or its passengers.

SPECIAL IFR— (See Fixed-Wing Special IFR)

SPECIAL INSTRUMENT APPROACH PROCEDURE— (See Instrument Approach Procedure)

SPECIAL USE AIRSPACE— Airspace of defined dimensions identified by an area on the surface of the earth wherein activities must be confined because of their nature and/or wherein limitations may be imposed upon aircraft operations that are not a part of those activities. TYPES OF SPECIAL USE AIRSPACE:

1. Alert Area—Airspace which may contain a high volume of pilot training activities or an unusual type of aerial activity, neither of which is hazardous to aircraft. Alert Areas are depicted on aeronautical charts for the information of nonparticipating pilots. All activities within an Alert Area are conducted in accordance with Federal Aviation Regulations, and pilots of participating aircraft as well as pilots transiting the area are equally responsible for collision avoidance.
2. Controlled Firing Area—Airspace wherein activities are conducted under conditions so controlled as to eliminate hazards to nonparticipating aircraft and to ensure the safety of persons and property on the ground.
3. Military Operations Area (MOA)—An MOA is an airspace assignment of defined vertical and lateral dimensions established outside positive control areas to separate/segregate certain military activities from IFR traffic and to identify for VFR traffic where these activities are conducted. (Refer to AIM).
4. Prohibited Area—Designated airspace within which the flight of aircraft is prohibited. (Refer to En Route Charts, AIM).
5. Restricted Area—Airspace designated under FAR, Part 73, within which the flight of aircraft, while not wholly prohibited, is subject to restriction. Most restricted areas are designated joint use and IFR/VFR operations in the area may be authorized by the controlling ATC facility when it is not being utilized by the using agency. Restricted areas are depicted on en route charts. Where joint use is authorized, the name of the ATC controlling facility is also shown. (Refer to FAR, Part 73 and AIM)
6. Warning Area—Airspace which may contain hazards to nonparticipating aircraft in international airspace.

SPECIAL VFR CONDITIONS— Weather conditions in a control zone which are less than basic VFR and in which some aircraft are permitted flight under Visual Flight Rules. (See Special VFR Operations) (Refer to FAR, Part 91)

SPECIAL VFR OPERATIONS— Aircraft operating in accordance with clearances within control zones in weather conditions less than the basic VFR weather minima. Such operations must be requested by the pilot and approved by ATC. (See Special VFR Conditions)

ICAO—SPECIAL VFR FLIGHT—A controlled VFR flight authorized by air traffic control to operate within a control zone under meteorological conditions below the visual meteorological conditions.

SPEED— (See Airspeed, Groundspeed)

SPEED ADJUSTMENT— An ATC procedure used to request pilots to adjust aircraft speed to a specific value for the purpose of providing desired spacing. Pilots are expected to maintain a speed of plus or minus 10 knots or 0.02 mach number of the specified speed.

Examples of speed adjustments are:

1. "Increase/reduce speed to mach point (number)."
2. "Increase/reduce speed to (speed in knots)" or "Increase/reduce speed (number of knots) knots."
3. "If practical, reduce speed to (speed);" or "If practical, reduce speed (number of) knots."

SPEED BRAKES/DIVE BRAKES— Moveable aerodynamic devices on aircraft that reduce airspeed during descent and landing.

SQUAWK (Mode, Code, Function)— Activate specific modes/codes/functions on the aircraft transponder; e.g., "Squawk three/alpha, two one zero five, low." (See Transponder)

STAGE I/II/III SERVICE— (See Terminal Radar Program)

STANDARD INSTRUMENT APPROACH PROCEDURE/SIAP— (See Instrument Approach Procedure)

STANDARD INSTRUMENT DEPARTURE/SID— A preplanned instrument flight rule (IFR) air traffic control departure procedure printed for pilot use in graphic and/or textual form. SID's provide transition from the terminal to the appropriate en route structure. (See IFR Takeoff Minima and Departure Procedures) (Refer to AIM)

STANDARD RATE TURN— A turn of three degrees per second.

STANDARD TERMINAL ARRIVAL/STAR— A preplanned instrument flight rule (IFR) air traffic control arrival procedure published for pilot use in graphic and/or textual form. STAR's provide transition from the en route structure to an outer fix or an instrument approach fix/arrival waypoint in the terminal area.

STAND BY— Means the controller or pilot must pause for a few seconds, usually to attend to other duties of a higher priority. Also means to wait as in "stand by for clearance." If a delay is lengthy, the caller should reestablish contact.

STATIONARY RESERVATIONS— Altitude reservations which encompass activities in a fixed area. Sta tionary reservations may include activities, such as special tests of weapons systems or equipment, certain U.S. Navy carrier, fleet, and anti-submarine operations, rocket, missile and drone operations, and certain aerial refueling or similar operations.

STEPDOWN FIX— A fix permitting additional descent within a segment of an instrument approach procedure by identifying a point at which a controlling obstacle has been safely overflown.

STEP TAXI— To taxi a float plane at full power or high RPM.

STEP TURN— A maneuver used to put a float plane in a planing configuration prior to entering an active sea lane for takeoff. The STEP TURN maneuver should only be used upon pilot request.

STEREO ROUTE— A routinely used route of flight established by users and ARTCC's identified by a coded name; e.g., ALPHA 2. These routes minimize flight plan handling and communications.

STOP ALTITUDE SQUAWK— Used by ATC to inform an aircraft to turn-off the automatic altitude reporting feature of its transponder. It is issued when the verbally reported altitude varies 300 feet or more from the automatic altitude report. (See Altitude Readout, Transponder)

STOP AND GO— A procedure wherein an aircraft will land, make a complete stop on the runway, and then commence a takeoff from that point. (See Low Approach, Option Approach)

STOPOVER FLIGHT PLAN— A flight plan format which permits in a single submission the filing of a sequence of flight plans through interim full-stop destinations to a final destination.

STOP SQUAWK (Mode or Code)— Used by ATC to tell the pilot to turn specified functions of the aircraft transponder off. (See Stop Altitude Squawk, Transponder)

STOP STREAM/BURST/BUZZER— Used by ATC to request a pilot to suspend electronic countermeasure activity. (See Jamming)

STOPWAY— An area beyond the takeoff runway designated by the airport authorities as able to support an airplane during an aborted takeoff. (Refer to FAR, Part 1)

STRAIGHT-IN APPROACH—IFR— An instrument approach wherein final approach is begun without first having executed a procedure turn, not necessarily completed with a straight-in landing or made to straight-in landing minimums. (See Straight-in Landing, Landing Minimums, Straight-in Approach-VFR)

STRAIGHT-IN APPROACH—VFR— Entry into the traffic pattern by interception of the extended runway centerline (final approach course) without executing any other portion of the traffic pattern. (See Traffic Pattern)

STRAIGHT-IN LANDING— A landing made on a runway aligned within 30° of the final approach course following completion of an instrument approach. (See Straight-in Approach-IFR)

STRAIGHT-IN LANDING MINIMUMS/STRAIGHT-IN MINIMUMS— (See Landing Minimums)

SUBSTITUTE ROUTE— A route assigned to pilots when any part of an airway or route is unusable because of NAVAID status. These routes consist of:

1. Substitute routes which are shown on U.S. Government charts.
2. Routes defined by ATC as specific NAVAID radials or courses.
3. Routes defined by ATC as direct to or between NAVAID's.

SUNSET AND SUNRISE— The mean solar times of sunset and sunrise as published in the Nautical Almanac, converted to local standard time for the locality concerned. Within Alaska, the end of evening civil twilight and the beginning of morning civil twilight, as defined for each locality.

SUPER HIGH FREQUENCY/SHF—The frequency band between 3 and 30 gigahertz (gHz). The elevation and azimuth stations of the microwave landing system operate from 5031MHz to 5091MHz in this spectrum.

SURVEILLANCE APPROACH— An instrument approach wherein the air traffic controller issues instructions, for pilot compliance, based on aircraft position in relation to the final approach course (azimuth), and the distance (range) from the end of the runway as displayed on the controller's radar scope. The controller will provide recommended altitudes on final approach if requested by the pilot. (See PAR Approach) (Refer to AIM)

SYSTEM STRATEGIC NAVIGATION (SN)— Military activity accomplished by navigating along a preplanned route using internal aircraft systems to maintain a desired track. This activity normally requires a lateral route width of 10NM and altitude range of 1,000 feet to 6,000 feet AGL with some route segments that permit terrain following.

TACAN-ONLY AIRCRAFT— An aircraft, normally military, possessing TACAN with DME but no VOR navigational system capability. Clearances must specify TACAN or VORTAC fixes and approaches.

TACTICAL AIR NAVIGATION/TACAN— An ultra-high frequency electronic rho-theta air navigation aid which provides suitably equipped aircraft a continuous indication of bearing and distance to the TACAN station. (See VORTAC) (Refer to AIM)

TARGET— The indication shown on a radar display resulting from a primary radar return or a radar beacon reply. (See Radar, Target Symbol)

ICAO—TARGET—In radar:

1. Generally, any discrete object which reflects or retransmits energy back to the radar equipment.
2. Specifically, an object of radar search or surveillance.

TARGET SYMBOL— A computer-generated indication shown on a radar display resulting from a primary radar return or a radar beacon reply.

TAXI— The movement of an airplane under its own power on the surface of an airport (FAR Part 135.100-Note). Also, it describes the surface movement of helicopters equipped with wheels. (See Air Taxi, Hover Taxi) (Refer to AIM)

TAXI INTO POSITION AND HOLD— Used by ATC to inform a pilot to taxi onto the departure runway in takeoff position and hold. It is not authorization for takeoff. It is used when takeoff clearance cannot immediately be issued because of traffic or other reasons. (See Hold, Cleared for Takeoff)

TAXI PATTERNS— Patterns established to illustrate the desired flow of ground traffic for the different runways or airport areas available for use.

TERMINAL AREA— A general term used to describe airspace in which approach control service or airport traffic control service is provided.

TERMINAL AREA FACILITY— A facility providing air traffic control service for arriving and departing IFR, VFR, Special VFR, and on occasion en route aircraft. (See Approach Control, Tower)

TERMINAL CONTROL AREA— (See Controlled Airspace)

TERMINAL RADAR PROGRAM— A national program instituted to extend the terminal radar services provided IFR aircraft to VFR aircraft. Pilot participation in the program is urged but is not mandatory. The program is divided into two parts and referred to as Stage II and Stage III. The Stage service provided at a particular location is contained in the Airport/Facility Directory.

1. Stage I originally comprised two basic radar services (traffic advisories and limited vectoring to VFR aircraft). These services are provided by all commissioned terminal radar facilities, but the term "Stage I" has been deleted from use.
2. Stage II/Radar Advisory and Sequencing for VFR Aircraft—Provides, in addition to the basic radar services, vectoring and sequencing on a full-time basis to arriving VFR aircraft. The purpose is to adjust the flow of arriving IFR and VFR aircraft into the traffic pattern in a safe and orderly manner and to provide traffic advisories to departing VFR aircraft.
3. Stage III/Radar Sequencing and Separation Service for VFR Aircraft—Provides, in addition to the basic radar services and Stage II, separation between all participating VFR aircraft. The purpose is to provide separation between all participating VFR aircraft and all IFR aircraft operating within the airspace defined as a Terminal Radar Service Area (TRSA) or Terminal Control Area (TCA). (See Controlled Airspace, Terminal Radar Service Area) (Refer to AIM, Airport/Facility Directory)

TERMINAL RADAR SERVICE AREA/TRSA— Airspace surrounding designated airports wherein ATC provides radar vectoring, sequencing, and separation on a full-time basis for all IFR and participating VFR aircraft. Service provided in a TRSA is called Stage III Service. The AIM contains an explanation of TRSA. TRSA's are depicted on VFR aeronautical charts. Pilot participation is urged but is not mandatory. (See Terminal Radar Program) (Refer to AIM, Airport/Facility Directory)

TERRAIN FOLLOWING/TF— The flight of a military aircraft maintaining a constant AGL altitude above the terrain or the highest obstruction. The altitude of the aircraft will constantly change with the varying terrain and/or obstruction.

TETRAHEDRON— A device normally located on uncontrolled airports and used as a landing direction indicator. The small end of a tetrahedron points in the direction of landing. At controlled airports, the tetrahedron, if installed, should be disregarded because tower instructions supersede the indicator. (See Segmented Circle) (Refer to AIM)

THAT IS CORRECT— The understanding you have is right.

THRESHOLD— The beginning of that portion of the runway usable for landing. (See Airport Lighting, Displaced Threshold)

THRESHOLD CROSSING HEIGHT/TCH— The theoretical height above the runway threshold at which the aircraft's glideslope antenna would be if the aircraft maintains the trajectory established by the mean ILS glideslope or MLS glidepath. (See Glide Slope, Threshold)

THRESHOLD LIGHTS— (See Airport Lighting)

TIME GROUP— Four digits representing the hour and minutes from the 24-hour clock. Time groups without time zone indicators are understood to be UTC (Coordinated Universal Time); e.g., "0205." A time zone designator is used to indicate local time; e.g., "0205M." The end and beginning of the day are shown by "2400" and "0000," respectively.

TORCHING— The burning of fuel at the end of an exhaust pipe or stack of a reciprocating aircraft engine, the result of an excessive richness in the fuel air mixture.

ICAO—TOTAL ESTIMATED ELAPSED TIME/TOTAL EET—For IFR flights, the estimated time required from takeoff to arrive over that designated point, defined by reference to navigation aids, from which it is intended that an instrument approach procedure will be commenced, or if no navigation aid is associated with the destination aerodrome, to arrive over the destination aerodrome. For VFR flights, the estimated time required from takeoff to arrive over the destination aerodrome (for use in international flight planning). (See Estimated Elapsed Time)

TOUCH-AND-GO/TOUCH-AND-GO LANDING— An operation by an aircraft that lands and departs on a runway without stopping or exiting the runway.

TOUCHDOWN—

1. The point at which an aircraft first makes contact with the landing surface.
2. Concerning a precision radar approach (PAR), it is the point where the glide path intercepts the landing surface.

ICAO—TOUCHDOWN— The point where the nominal glide path intercepts the runway.

TOUCHDOWN RVR— (See Visibility)

TOUCHDOWN ZONE— The first 3,000 feet of the runway beginning at the threshold. The area is used for determination of Touchdown Zone Elevation in the development of straight-in landing minimums for instrument approaches.

TOUCHDOWN ZONE ELEVATION/TDZE— The highest elevation in the first 3,000 feet of the landing surface. TDZE is indicated on the instrument approach procedure chart when straight-in landing minimums are authorized. (See Touchdown Zone)

TOUCHDOWN ZONE LIGHTING— (See Airport Lighting)

TOWER/AIRPORT TRAFFIC CONTROL TOWER— A terminal facility that uses air/ground communications, visual signaling, and other devices to provide ATC services to aircraft operating in the vicinity of an airport or on the movement area. Authorizes aircraft to land or takeoff at the airport controlled by the tower or to transit the airport traffic area regardless of flight plan or weather conditions (IFR or VFR). A tower may also provide approach control services (radar or nonradar). (See Airport Traffic Area, Airport Traffic Control Service, Approach Control/Approach Control Facility, Approach Control Service, Movement Area, Tower En Route Control Service/Tower to Tower) (Refer to AIM)

ICAO—AERODROME CONTROL TOWER— A unit established to provide air traffc control service to aerodrome traffic.

TOWER EN ROUTE CONTROL SERVICE/TOWER TO TOWER— The control of IFR en route traffic within delegated airspace between two or more adjacent approach control facilities. This service is designed to expedite traffic and reduce control and pilot communication requirements.

TPX-42— A numeric beacon decoder equipment/system. It is designed to be added to terminal radar systems for beacon decoding. It provides rapid target identification, reinforcement of the primary radar target, and altitude information from Mode C. (See Automated Radar Terminal Systems, Transponder)

TRACK— The actual flight path of an aircraft over the surface of the earth. (See Course, Route, Flight Path)

*ICAO—TRACK—*The projection on the earth's surface of the path of an aircraft, the direction of which path at any point is usually expressed in degrees from north (true, magnetic, or grid).

TRAFFIC—

1. A term used by a controller to transfer radar identification of an aircraft to another controller for the purpose of coordinating separation action. Traffic is normally issued (a) in response to a handoff or point out, (b) in anticipation of a handoff or point out, or (c) in conjunction with a request for control of an aircraft.
2. A term used by ATC to refer to one or more aircraft.

TRAFFIC ADVISORIES— Advisories issued to alert pilots to other known or observed air traffic which may be in such proximity to the position or intended route of flight of their aircraft to warrant their attention. Such advisories may be based on:

1. Visual observation.
2. Observation of radar identified and nonidentified aircraft targets on an ATC radar display, or
3. Verbal reports from pilots or other facilities.

The word "traffic" followed by additional information, if known, is used to provide such advisories; e.g., "Traffic, 2 o'clock, one zero miles, southbound, eight thousand."

Traffic advisory service will be provided to the extent possible depending on higher priority duties of the controller or other limitations; e.g., radar limitations, volume of traffic, frequency congestion, or controller workload. Radar/nonradar traffic advisories do not relieve the pilot of his responsibility to see and avoid other aircraft. Pilots are cautioned that there are many times when the controller is not able to give traffic advisories concerning all traffic in the aircraft's proximity; in other words, when a pilot requests or is receiving traffic advisories, he should not assume that all traffic will be issued. (Refer to AIM, Radar Traffic Information Service)

(Identification), TRAFFIC ALERT. ADVISE YOU TURN LEFT/RIGHT (specific heading if appropriate), AND/OR CLIMB/DESCEND (specific altitude if appropriate) IMMEDIATELY. (See Safety Alert)

TRAFFIC INFORMATION— (See Traffic Advisories)

TRAFFIC IN SIGHT— Used by pilots to inform a controller that previously issued traffic is in sight. (See Negative Contact, Traffic Advisories)

TRAFFIC NO LONGER A FACTOR— Indicates that the traffic described in a previously issued traffic advisory is no longer a factor.

TRAFFIC PATTERN— The traffic flow that is prescribed for aircraft landing at, taxiing on, or taking off from an airport. The components of a typical traffic pattern are upwind leg, crosswind leg, downwind leg, base leg, and final approach.

1. Upwind Leg—A flight path parallel to the landing runway in the direction of landing.
2. Crosswind Leg—A flight path at right angles to the landing runway off its upwind end.
3. Downwind Leg—A flight path parallel to the landing runway in the direction opposite to landing. The downwind leg normally extends between the crosswind leg and the base leg.
4. Base Leg—A flight path at right angles to the landing runway off its approach end. The base leg normally extends from the downwind leg to the intersection of the extended runway centerline.

5. Final Approach—A flight path in the direction of landing along the extended runway centerline. The final approach normally extends from the base leg to the runway. An aircraft making a straight-in approach VFR is also considered to be on final approach.

(See Straight-In Approach—VFR, Taxi Patterns) (Refer to AIM, FAR Part 91)

ICAO—AERODROME TRAFFIC CIRCUIT— The specified path to be flown by aircraft operating in the vicinity of an aerodrome.

TRANSCRIBED WEATHER BROADCAST/TWEB— A continuous recording of meteorological and aeronautical information that is broadcast on L/MF and VOR facilities for pilots. (Refer to AIM)

TRANSFER OF CONTROL— That action whereby the responsibility for the separation of an aircraft is transferred from one controller to another.

ICAO—TRANSFER OF CONTROL— Transfer of responsibility for providing air traffic control service.

TRANSFERRING CONTROLLER/FACILITY— A controller/facility transferring control of an aircraft to another controller/facility.

ICAO—TRANSFERRING UNIT/CONTROLLER— Air Traffic Control Unit/Air Traffic Controller in the process of transferring the responsibility for providing air traffic control service to an aircraft to the next air traffic control unit/air traffic controller along the route of flight.

TRANSITION—

1. The general term that describes the change from one phase of flight or flight condition to another; e.g., transition from en route flight to the approach or transition from instrument flight to visual flight.
2. A published procedure (SID Transition) used to connect the basic SID to one of several en route airways/jet routes, or a published procedure (STAR Transition) used to connect one of several en route airways/jet routes to the basic STAR. (Refer to SID/STAR Charts)

TRANSITION AREA— (See Controlled Airspace)

TRANSMISSOMETER— An apparatus used to determine visibility by measuring the transmission of light through the atmosphere. It is the measurement source for determining runway visual range (RVR) and runway visibility value (RVV). (See Visibility)

TRANSMITTING IN THE BLIND/BLIND TRANSMISSION— A transmission from one station to other stations in circumstances where two-way communication cannot be established, but where it is believed that the called stations may be able to receive the transmission.

TRANSPONDER— The airborne radar beacon receiver/transmitter portion of the Air Traffic Control Radar Beacon System (ATCRBS) which automatically receives radio signals from interrogators on the ground, and selectively replies with a specific reply pulse or pulse group only to those interrogations being received on the mode to which it is set to respond. (See Interrogator) (Refer to AIM)

*ICAO—TRANSPONDER—*A receiver/transmitter which will generate a reply signal upon proper interrogation; the interrogation and reply being on different frequencies.

TURBOJET AIRCRAFT— An aircraft having a jet engine in which the energy of the jet operates a turbine which in turn operates the air compressor.

TURBOPROP AIRCRAFT— An aircraft having a jet engine in which the energy of the jet operates a turbine which drives the propeller.

T-VOR/TERMINAL-VERY HIGH FREQUENCY OMNIDIRECTIONAL RANGE STATION— A very high frequency terminal omnirange station located on or near an airport and used as an approach aid. (See Navigational Aid, VOR)

TWO WAY RADIO COMMUNICATIONS FAILURE— (See Lost Communications)

ULTRAHIGH FREQUENCY/UHF— The frequency band between 300 and 3,000 MHz. The bank of radio frequencies used for military air/ground voice communications. In some instances this may go as low as 225 MHz and still be referred to as UHF.

ULTRALIGHT VEHICLE— An aeronautical vehicle operated for sport or recreational purposes which does not require FAA registration, an airworthiness certificate, nor pilot certification. They are primarily single occupant vehicles, although some two-place vehicles are authorized for training purposes. Operation of an ultralight vehicle in certain airspace requires authorization from ATC. (See FAR 103)

UNABLE— Indicates inability to comply with a specific instruction, request, or clearance.

UNCONTROLLED AIRSPACE— Uncontrolled airspace is that portion of the airspace that has not been designated as continental control area, control area, control zone, terminal control area, or transition area and within which ATC has neither the authority nor the responsibility for exercising control over air traffic. (See Controlled Airspace)

UNDER THE HOOD— Indicates that the pilot is using a hood to restrict visibility outside the cockpit while simulating instrument flight. An appropriately rated pilot is required in the other control seat while this operation is being conducted. (Refer to FAR, Part 91)

UNICOM— A nongovernment communication facility which may provide airport information at certain airports. Locations and frequencies of UNICOMs are shown on aeronautical charts and publications. (Refer to AIM, Airport/Facility Directory)

UNPUBLISHED ROUTE— A route for which no minimum altitude is published or charted for pilot use. It may include a direct route between NAVAIDS, a radial, a radar vector, or a final approach course beyond the segments of an instrument approach procedure. (See Published Route, Route)

UPWIND LEG— (See Traffic Pattern)

URGENCY— A condition of being concerned about safety, and of requiring timely but not immediate assistance; a potential Distress condition.

ICAO—URGENCY— A condition concerning the safety of an aircraft or other vehicle, or of person on board or in sight, but which does not require immediate assistance.

VECTOR— A heading issued to an aircraft to provide navigational guidance by radar.

ICAO—RADAR VECTORING— Provision of navigational guidance to aircraft in the form of specific headings, based on the use of radar.

VERIFY— Request confirmation of information; e.g., "verify assigned altitude."

VERIFY SPECIFIC DIRECTION OF TAKEOFF (OR TURNS AFTER TAKEOFF)— Used by ATC to ascertain an aircraft's direction of takeoff and/or direction of turn after takeoff. It is normally used for IFR departures from an airport not having a control tower. When direct communication with the pilot is not possible, the request and information may be relayed through an FSS, dispatcher, or by other means. (See IFR Takeoff Minimums and Departure Procedures)

VERTICAL SEPARATION— Separation established by assignment of different altitudes or flight levels. (See Separation)

*ICAO—VERTICAL SEPARATION—*Separation between aircraft expressed in units of vertical distance.

VERTICAL TAKEOFF AND LANDING AIRCRAFT/VTOL AIRCRAFT— Aircraft capable of vertical climbs and/or descents and of using very short runways or small areas for takeoff and landings. These aircraft include, but are not limited to, helicopters. (See Short Takeoff and Landing Aircraft)

VERY HIGH FREQUENCY/VHF— The frequency band between 30 and 300 MHz. Portions of this band, 108 to 118 MHz, are used for certain NAVAIDS; 118 to 136 MHz are used for civil air/ground voice communications. Other frequencies in this band are used for purposes not related to air traffic control.

VERY LOW FREQUENCY/VLF— The frequency band between 3 and 30 kHz.

VFR AIRCRAFT/VFR FLIGHT— An aircraft conducting flight in accordance with visual flight rules. (See Visual Flight Rules)

VFR CONDITIONS— Weather conditions equal to or better than the minimum for flight under visual flight rules. The term may be used as an ATC clearance/instruction only when:

1. An IFR aircraft requests a climb/descent in VFR conditions.
2. The clearance will result in noise abatement benefits where part of the IFR departure route does not conform to an FAA approved noise abatement route or altitude.
3. A pilot has requested a practice instrument approach and is not on an IFR flight plan.

All pilots receiving this authorization must comply with the VFR visibility and distance from cloud criteria in FAR Part 91. Use of the term does not relieve controllers of their responsibility to separate aircraft in TCAs/TRSAs as required by FAA Handbook 7110.65. When used as an ATC clearance/instruction, the term may be abbreviated "VFR;" e.g., "MAINTAIN VFR," "CLIMB/DESCEND VFR," etc.

VFR-ON-TOP— ATC authorization for an IFR aircraft to operate in VFR conditions at any appropriate VFR altitude (as specified in FAR and as restricted by ATC). A pilot receiving this authorization must comply with the VFR visibility, distance from cloud criteria, and the minimum IFR altitudes specified in FAR Part 91. The use of this term does not relieve controllers of their responsibility to separate aircraft in TCAs/TRSAs as required by FAA Handbook 7110.65.

VFR MILITARY TRAINING ROUTES (VR)— Routes used by the Department of Defense and associated Reserve and Air Guard units for the purpose of conducting low-altitude navigation and tactical training under VFR below 10,000 feet MSL at airspeeds in excess of 250 knots IAS.

VFR NOT RECOMMENDED— An advisory provided by a flight service station to a pilot during a preflight or inflight weather briefing that flight under visual flight rules is not recommended. To be given when the current and/or forecasted weather conditions are at or below VFR minimums. It does not abrogate the pilot's authority to make his own decision.

VIDEO MAP— An electronically displayed map on the radar display that may depict data such as airports, heliports, runway centerline extensions, hospital emergency landing areas, NAVAIDS and fixes, reporting points, airway/route centerlines, boundaries, handoff points, special use tracks, obstructions, prominent geographic features, map alignment indicators, range accuracy marks, minimum vectoring altitudes.

VISIBILITY— The ability, as determined by atmospheric conditions and expressed in units of distance, to see and identify prominent unlighted objects by day and prominent lighted objects by night. Visbility is reported as statute miles, hundreds of feet or meters. (Refer to FAR Part 91, AIM)

1. Flight Visibility—The average forward horizontal distance, from the cockpit of an aircraft in flight, at which prominent unlighted objects may be seen and identified by day and prominent lighted objects may be seen and identified by night.

*ICAO—Flight Visibility—*The visibility forward from the cockpit of an aircraft in flight.

2. Ground Visibility—Prevailing horizontal visibility near the earth's surface as reported by the United States National Weather Service or an accredited observer.

*ICAO—Ground Visibility—*The visibility at an aerodrome as reported by an accredited observer.

3. Prevailing Visibility—The greatest horizontal visibility equaled or exceeded throughout at least

half the horizon circle which need not necessarily be continuous.

4. Runway Visibility Value/RVV—The visibility determined for a particular runway by a transmissometer. A meter provides a continuous indication of the visibility (reported in miles or fractions of miles) for the runway. RVV is used in lieu of prevailing visibility in determining minimums for a particular runway.

5. Runway Visual Range/RVR—An instrumentally derived value, based on standard calibrations, that represents the horizontal distance a pilot will see down the runway from the approach end. It is based on the sighting of either high intensity runway lights or on the visual contrast of other targets whichever yields the greater visual range. RVR, in contrast to prevailing or runway visibility, is based on what a pilot in a moving aircraft should see looking down the runway. RVR is horizontal visual range, not slant visual range. It is based on the measurement of a transmissometer made near the touchdown point of the instrument runway and is reported in hundreds of feet. RVR is used in lieu of RVV and/or prevailing visibility in determining minimums for a particular runway.

    a. Touchdown RVR—The RVR visibility readout values obtained from RVR equipment serving the runway touchdown zone.
    b. MID RVR—The RVR readout values obtained from RVR equipment located midfield of the runway.
    c. Rollout RVR—The RVR readout values obtained from RVR equipment located nearest the rollout end of the runway.

ICAO—Runway Visual Range—The maximum distance in the direction of takeoff or landing at which the runway or the specified lights or markers delineating it can be seen from a position above a specified point on its centerline at a height corresponding to the average eye-level of pilots at touchdown.

VISUAL APPROACH— An approach wherein an aircraft on an IFR flight plan, operating in VFR conditions under the control of an air traffic control facility and having an air traffic control authorization, may proceed to the airport of destination in VFR conditions.

ICAO—VISUAL APPROACH—An approach by an IFR flight when either part or all of an instrument approach procedure is not completed and the approach is executed in visual reference to terrain.

VISUAL APPROACH SLOPE INDICATOR— (See Airport Lighting)

VISUAL DESCENT POINT/VDP— A defined point on the final approach course of a nonprecision straight-in approach procedure from which normal descent from the MDA to the runway touchdown point may be commenced, provided the approach threshold of that runway, or approach lights, or other markings identifiable with the approach end of that runway are clearly visible to the pilot.

VISUAL FLIGHT RULES/VFR— Rules that govern the procedures for conducting flight under visual conditions. The term "VFR" is also used in the United States to indicate weather conditions that are equal to or greater than minimum VFR requirements. In addition, it is used by pilots and controllers to indicate type of flight plan. (See Instrument Flight Rules, Instrument Meteorological Conditions, Visual Meteorological Conditions) (Refer to FAR, Part 91 and AIM)

VISUAL HOLDING— The holding of aircraft at selected, prominent geographical fixes which can be easily recognized from the air. (See Hold, Holding Fixes)

VISUAL METEOROLOGICAL CONDITIONS/VMC— Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling equal to or better than specified minima. (See Instrument Flight Rules, Instrument Meteorological Conditions, Visual Flight Rules)

VISUAL SEPARATION— A means employed by ATC to separate aircraft in terminal areas. There are two ways to effect this separation:

1. The tower controller sees the aircraft involved and issues instructions, as necessary, to ensure that the aircraft avoid each other.
2. A pilot sees the other aircraft involved and upon instructions from the controller provides his own separation by maneuvering his aircraft as necessary to avoid it. This may involve following another aircraft or keeping it in sight until it is no longer a factor. (See See and Avoid) (Refer to FAR, Part 91)

VORTAC/VHF OMNIDIRECTIONAL RANGE/TACTICAL AIR NAVIGATION— A navigation aid providing VOR azimuth, TACAN azimuth, and TACAN distance measuring equipment (DME) at one site. (See Distance Measuring Equipment, Navigational Aid TACAN, VOR) (Refer to AIM)

VORTICES/WING TIP VORTICES— Circular patterns of air created by the movement of an airfoil through the air when generating lift. As an airfoil moves through the atmosphere in sustained flight, an area of area of low pressure is created above it. The air flowing from the high pressure area to the low pressure area around and about the tips of the airfoil tends to roll up into two rapidly rotating vortices, cylindrical in shape. These vortices are the most predominant parts of aircraft wake turbulence and their rotational force is dependent upon the wing loading, gross weight, and speed of the generating aircraft. The vortices from medium to heavy aircraft can be of extremely high velocity and hazardous to smaller aircraft. (See Aircraft Classes Wake Turbulence) (Refer to AIM)

VOR/VERY HIGH FREQUENCY OMNIDIRECTIONAL RANGE STATION— A ground-based electronic navigation aid transmitting very high frequency navigation signals, 360 degrees in azimuth, oriented from magnetic north. Used as the basis for navigation in the National Airspace System. The VOR periodically identifies itself by Morse Code and may have an additional voice identification feature. Voice features may be used by ATC or FSS for transmitting instructions/information to pilots. (See Navigational Aid) (Refer to AIM)

VOT/VOR TEST SIGNAL— A ground facility which emits a test signal to check VOR receiver accuracy. Some VOT's are available to the user while airborne, and others are limited to ground use only. (Refer to FAR, Part 91, AIM, Airport/Facility Directory)

WAKE TURBULENCE— Phenomena resulting from the passage of an aircraft through the atmosphere. The term includes vortices, thrust stream turbulence, jet blast, jet wash, propeller wash, and rotor wash both on the ground and in the air. (See Aircraft Classes, Jet Blast, Vortices) (Refer to AIM)

WARNING AREA— (See Special Use Airspace)

WAYPOINT— A predetermined geographical position used for route/instrument approach definition, or progress reporting purposes, that is defined relative to a VORTAC station or in terms of latitude/longitude coordinates.

WEATHER ADVISORY/INFLIGHT WEATHER ADVISORY— (See SIGMET, AIRMET)

WEATHER ADVISORY/WS/WST/WA/CWA— In aviation weather forecast practice, an expression of hazardous weather conditions not predicted in the area forecast, as they affect the operation of air traffic and as prepared by the NWS.

WHEN ABLE— When used in conjunction with ATC instructions, gives the pilot the latitude to delay compliance until a condition or event has been reconciled. Unlike "pilot discretion," when instructions are prefaced "when able," the pilot is expected to seek the first opportunity to comply. Once a maneuver has been initiated, the pilot is expected to continue until the specifications of the instructions have been met. "When able," should not be used when expeditious compliance is required.

WILCO— I have received your message, understand it, and will comply with it.

WIND SHEAR— A change in wind speed and/or wind direction in a short distance resulting in a tearing or shearing effect. It can exist in a horizontal or vertical direction and occasionally in both.

WORDS TWICE—

1. As a request: "Communication is difficult. Please say every phrase twice."
2. As information: "Since communications are difficult, every phrase in this message will be spoken twice."

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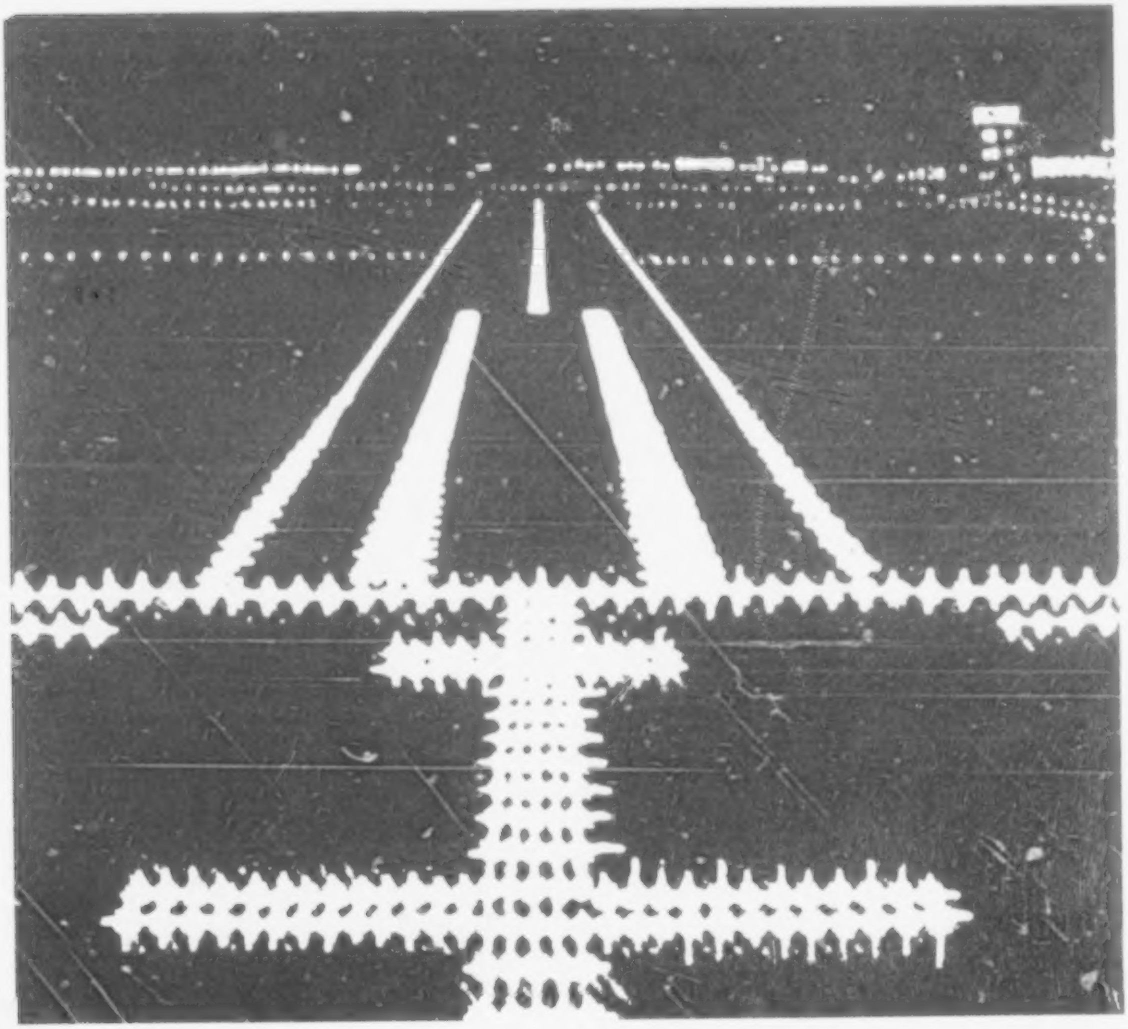

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This manual is designed to provide airmen with basic flight information and ATC procedures for use in the National Airspace System (NAS) of the United States. The information contained parallels the U.S. Aeronautical Information Publication (AIP) distributed internationally.

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EXPLANATION OF MAJOR CHANGES

Para 12. k (3) INSTRUMENT LANDING SYSTEM (ILS)— This change incorporates new ILS FAF definition, and entire paragraph edited for clarity.

Para 23. INERTIAL NAVIGATION SYSTEM (INS)— Paragraph added to include information on systems being used for air naviagation purposes.

Para 24. DOPPLER RADAR— Paragraph added to include information on systems being used for air naviagation purposes.

Para 25. FLIGHT MANAGEMENT SYSTEM (FMS)— Paragraph added to include information on systems being used for air naviagation purposes.

Para 26. GLOBAL POSITIONING SYSTEM (GPS)— Paragraph added to include information on systems being used for air navigation purposes.

Para 97. b (2) (d) TERMINAL CONTROL AREA (TCA) OPERATION— Paragraph revised to include "Charted VFR Flyway Planning Chart" program.

Para 101. AIRPORT RADAR SERVICE AREA (ARSA) OPERATION— Paragraph revised for clarity.

Para 157. f (4) (a) TRAFFIC ADVISORY PRACTICES AT AIRPORTS WITHOUT OPERATING CONTROL TOWERS— This change incorporates new ILS FAF definition.

Para 163. a (1) EXAMPLE. SAFETY ALERT— This change incorporates new ILS FAF definition.

Para 163. a (2) SAFETY ALERT— This change incorporates new FAA ARTS IIA facilities.

Para 192. CONTACT PROCEDURES— Paragraph revised to clarify the use of the word "OVER" in radio communications. It is not mandatory if radio reception is reasonably assured.

Para 193. AIRCRAFT CALL SIGNS— Paragraph revised to clarify the use of the word "OVER" in radio communications. It is not mandatory if radio reception is reasonably assured.

Para 222. a (3) VISUAL INDICATORS AT UNCONTROLLED AIRPORTS— Paragraph expanded to clarify airport tetrahedron use.

Para 225. WIND DIRECTION AND VELOCITY— Paragraph deleted, information contained in Paragraph 226.

Para 226. a USE OF RUNWAYS— Paragraph change provides clarification in determining runway numbering designations and information that was contained in Paragraph 225.

Para 231. a (2) (8) SIMULTANEOUS OPERATIONS ON INTERSECTING RUNWAYS— Paragraph revised to be consistent with other publications.

Para 232. c LOW APPROACH— This change incorporates new ILS FAF definition.

Para 233. a TRAFFIC CONTROL LIGHT SIGNALS— Paragraph and Table changed to include additional information regarding light gun signals for ground vehicles, equipment, and personnel.

Para 241. EXAMPLE. TAXIING— Paragraph revised to clarify the use of the word "OVER" in radio communications. It is not mandatory if radio reception is reasonably assured.

Para 241. a (7) TAXIING— New subparagraph added to include taxi instruction when *Hold Short* instructions will be issued.

Para 244. h PRACTICE INSTRUMENT APPROACHES— This change incorporates new ILS FAF definition.

Para 246. c USE OF AIRCRAFT LIGHTS— Paragraph revised to expand the use of aircraft lights.

Para 266. IFR CLEARANCE VFR-ON-TOP— Paragraph retitled to help clarify the use of VFR-ON-TOP and responsibilities of both the pilot and controllers.

Para 297. b COMPOSITE FLIGHT PLAN (VFR/IFR FLIGHTS)— Paragraph revised for clarity.

Para 300. b FLIGHTS OUTSIDE THE UNITED STATES AND U.S. TERRITORIES— Paragraph expanded to include the need to continuously guard the VHF Emergency Frequency 121.5 MHz when on long over-water flights.

Para 323. DEPARTURE RESTRICTIONS, CLEARANCE VOID TIMES, HOLD FOR RELEASE, AND RELEASE TIMES— Paragraph retitled and expanded to include departure restrictions, hold for release, release times, and to clarify the same.

Para 340. ARTCC COMMUNICATIONS— Paragraph revised to clarify the use of the word "OVER" in radio communications. It is not mandatory if radio reception is reasonably assured.

Para 342. a (2) (a) ADDITIONAL REPORTS— This change incorporates new ILS FAF definition.

Para 347. j (6) (c) HOLDING— Subparagraph demonstrates realistic pilot techniques to compensate for wind effect during holding.

Para 363. c ADVANCE INFORMATION ON INSTRUMENT APPROACH— This change incorporates new ILS FAF definition.

Para 370. g INSTRUMENT APPROACH PROCEDURES— This change incorporates new ILS FAF definition.

Para 371. a (3) PROCEDURE TURN— This change incorporates new ILS FAF definition.

Para 372. b TIME APPROACHES FROM A HOLDING FIX— This change incorporates new ILS FAF definition.

Para 373. c (1) RADAR APPROACHES— Paragraph expanded for clarification.

Para 374. c (1) RADAR MONITORING OF INSTRUMENT APPROACHES— This change incorporates new ILS FAF definition.

Para 377. SIMULTANEOUS CONVERGING INSTRUMENT APPROACHES— New paragraph added.

Para 412. VFR-ON-TOP— Paragraph established to clarify the use of VFR-ON-TOP and the roles and responsibilities of both the pilot and controllers.

Para 413. INSTRUMENT DEPARTURES— Paragraph renumbered to accommodate new paragraph 412.

Para 414. MINIMUM FUEL ADVISORY— Paragraph renumbered to accommodate new paragraph 412.

Para 500. a NATIONAL WEATHER SERVICE AVIATION PRODUCTS— Paragraph revised to eliminate information pertaining to weather observing systems.

Para 501. FAA WEATHER SERVICES— Interim Voice Response System (IVRS) has replaced the Voice Response Demonstration Program, this paragraph is revised to reflect this expansion in service.

Para 503. c EN ROUTE FLIGHT ADVISORY SERVICE (EFAS)— Paragraph updated to show latest change.

Para 504. IN-FLIGHT WEATHER ADVISORIES— Paragraph expanded to include Center Weather Advisory (CWA).

Para 508. IN-FLIGHT WEATHER BROADCASTS— Paragraph expanded to include Center Weather Advisory (CWA), and update Hazardous In-Flight Weather Advisory Service (HIWAS).

Para 509. WEATHER OBSERVING PROGRAMS— Paragraph retitled and expanded to include all surface weather observing programs.

Para 525. MICROBURSTS— New paragraph added.

Para 526. THUNDERSTORMS— Paragraph renumbered to accommodate new paragraph 525.

Para 527. THUNDERSTORM FLYING— Paragraph renumbered to accommodate new paragraph 525.

Para 528. KEY TO AVIATION WEATHER OBSERVATIONS AND FORECASTS— Paragraph renumbered to accommodate new paragraph 525.

Para 529. AUTOB DECODING KEY— Paragraph renumbered to accommodate new paragraph 525.

Para 533. HIGH BAROMETRIC PRESSURE— New paragraph added.

Para 565. b FLIGHTS OVER CHARTED U.S. WILDLIFE REFUGES, PARKS, AND FOREST SERVICE AREAS— Note added to bring to all pilots attention the voluntary minimum altitude for National Park Areas overflight as delineated in FAA Advisory Circular 91-36.

Para 623. f GENERAL DESCRIPTION OF EACH CHART SERIES— Paragraph revised to include "Charted VFR Flyway Planning Chart" program.

EXTERNAL REFERENCES

All reference to Advisory Circulars and other FAA publications in the Airman's Information Manual include the FAA Advisory Circular or Manual identification numbers (when available); however, due to varied publication dates, the basic publication letter is not included (Example: The Controller's Handbook 7110.65D is referenced as 7110.65.) To insure that you are consulting the latest information when referencing one of these other documents, use the FAA Advisory Circular AC: 00-2XX, Advisory Circular Checklist (and Status of Other FAA Publications).

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Chapter 1. NAVIGATION AIDS

Section 1. AIR NAVIGATION RADIO AIDS

1. GENERAL

Various types of air navigation aids are in use today, each serving a special purpose. These aids have varied owners and operators namely: the Federal Aviation Administration (FAA), the military services, private organizations, individual states and foreign governments. The FAA has the statutory authority to establish, operate, maintain air navigation facilities and to prescribe standards for the operation of any of these aids which are used for instrument flight in federally controlled airspace. These aids are tabulated in the Airport/Facility Directory.

2. NONDIRECTIONAL RADIO BEACON (NDB)

a. A low or medium frequency radio beacon transmits nondirectional signals whereby the pilot of an aircraft properly equipped can determine his bearing and "home" on the station. These facilities normally operate in the frequency band of 190 to 535 kHz and transmit a continuous carrier with either 400 or 1020 Hz modulation. All radio beacons except the compass locators transmit a continuous three-letter identification in code except during voice transmissions.

b. When a radio beacon is used in conjunction with the Instrument Landing System markers, it is called a Compass Locator.

c. Voice transmissions are made on radio beacons unless the letter "W" (without voice) is included in the class designator (HW).

d. Radio beacons are subject to disturbances that may result in erroneous bearing information. Such disturbances result from such factors as lightning, precipitation static, etc. At night radio beacons are vulnerable to interference from distant stations. Nearly all disturbances which affect the ADF bearing also affect the facility's identification. Noisy identification usually occurs when the ADF needle is erratic. Voice, music or erroneous identification may be heard when a steady false bearing is being displayed. Since ADF receivers do not have a "FLAG" to warn the pilot when erroneous bearing information is being displayed, the pilot should continuously monitor the NDB's identification.

3. VHF OMNI-DIRECTIONAL RANGE (VOR)

a. VORs operate within the 108.0 to 117.95 MHz frequency band and have a power output necessary to provide coverage within their assigned operational service volume. It is subject to line-of-sight restriction, and the range varies proportionally to the altitude of the receiving equipment. The normal service ranges for the various classes of VORs are given in PARA. 10.d.

b. Most VORs are equipped for voice transmission on the VOR frequency. VORs without voice capability are indicated by the letter "W" (without voice) included in the class designator (VORW).

c. The only positive method of identifying a VOR is by its Morse Code identification or by the recorded automatic voice identification which is always indicated by use of the word "VOR" following the range's name. Reliance on determining the identification of an omnirange should never be placed on listening to voice transmissions by the Flight Service Station (FSS) (or approach control facility) involved. Many FSSs remotely operate several omniranges with different names. In some cases, none of the VORs have the name of the "parent" FSS. During periods of maintenance, the facility may radiate a T-E-S-T code (— ● ●●● —) or the code may be removed.

d. Voice identification has been added to numerous VORs. The transmission consists of a voice announcement, "AIRVILLE VOR" alternating with the usual Morse Code identification.

e. The effectiveness of the VOR depends upon proper use and adjustment of both ground and airborne equipment.

(1) Accuracy: The accuracy of course alignment of the VOR is excellent, being generally plus or minus 1 degree.

(2) Roughness: On some VORs, minor course roughness may be observed, evidenced by course needle or brief flag alarm activity (some receivers are more susceptible to these irregularities than others). At a few stations, usually in mountainous terrain, the pilot may occasionally observe a brief course needle oscillation, similar to the indication of "approaching station." Pilots flying over unfamiliar routes are cautioned to be on the alert for these vagaries, and in particular, to use the "to/from" indicator to determine positive station passage.

(a) Certain propeller RPM settings or helicopter rotor speeds can cause the VOR Course Deviation Indicator to fluctuate as much as plus or minus six degrees. Slight changes to the RPM setting will normally smooth out this roughness. Pilots are urged to check for this modulation phenomenon prior to reporting a VOR station or aircraft equipment for unsatisfactory operation.

4. VOR RECEIVER CHECK

a. The FAA VOR test facility (VOT) transmits a test signal which provides users a convenient means to determine the operational status and accuracy of a VOR receiver while on the ground where a VOT is located. The airborne use of VOT is permitted; however, its use is strictly limited to those areas/altitudes specifically authorized in the Airport/Facility Directory or appropriate supplement.

b. To use the VOT service,tune in the VOT frequency on your VOR receiver. With the Course Deviation Indicator (CDI) centered, the omni-bearing selector should read 0 de-

grees with the to/from indication showing "from" or the omni-bearing selector should read 180 degrees with the to/from indication showing "to". Should the VOR receiver operate an RMI (Radio Magnetic Indicator), it will indicate 180 degrees on any OBS setting. Two means of identification are used. One is a series of dots and the other is a continuous tone. Information concerning an individual test signal can be obtained from the local FSS.

c. Periodic VOR receiver calibration is most important. If a receiver's Automatic Gain Control or modulation circuit deteriorates, it is possible for it to display acceptable accuracy and sensitivity close into the VOR or VOT and display out-of-tolerance readings when located at greater distances where weaker signal areas exist. The likelihood of this deterioration varies between receivers, and is generally considered a function of time. The best assurance of having an accurate receiver is periodic calibration. Yearly intervals are recommended at which time an authorized repair facility should recalibrate the receiver to the manufacturer's specifications.

d. Federal Aviation Regulations (FAR 91.25) provides for certain VOR equipment accuracy checks prior to flight under instrument flight rules. To comply with this requirement and to ensure satisfactory operation of the airborne system, the FAA has provided pilots with the following means of checking VOR receiver accuracy:

(1) VOT or a radiated test signal from an appropriately rated radio repair station.

(2) Certified airborne check points.

(3) Certified check points on the airport surface.

e. A radiated VOR test signal from an appropriately rated radio repair station serves the same purpose as an FAA VOR signal and the check is made in much the same manner as a VOT with the following differences:

(1) The frequency normally approved by the FCC is 108.0 MHz.

(2) Repair stations are not permitted to radiate the VOR test signal continuously; consequently, the owner or operator must make arrangements with the repair station to have the test signal transmitted. This service is not provided by all radio repair stations. The aircraft owner or operator must determine which repair station in his local area provides this service. A representative of the repair station must make an entry into the aircraft logbook or other permanent record certifying to the radial accuracy and the date of transmission. The owner, operator or representative of the repair station may accomplish the necessary checks in the aircraft and make a logbook entry stating the results. It is necessary to verify which test radial is being transmitted and whether you should get a "to" or "from" indication.

f. Airborne and ground check points consist of certified radials that should be received at specific points on the airport surface or over specific landmarks while airborne in the immediate vicinity of the airport.

(1) Should an error in excess of plus or minus 4 degrees be indicated through use of a ground check, or plus or minus 6 degrees using the airborne check, IFR flight shall not be attempted without first correcting the source of the error.

> *CAUTION:* No correction other than the correction card figures supplied by the manufacturer should be applied in making these VOR receiver checks.

(2) Locations of airborne check points, ground check points and VOTs are published in the Airport/Facility Directory.

(3) If a dual system VOR (units independent of each other except for the antenna) is installed in the aircraft one system may be checked against the other. Turn both systems to the same VOR ground facility and note the indicated bearing to that station. The maximum permissible variations between the two indicated bearings is 4 degrees.

5. TACTICAL AIR NAVIGATION (TACAN)

a. For reasons peculiar to military or naval operations (unusual siting conditions, the pitching and rolling of a naval vessel, etc.) the civil VOR/DME system of air navigation was considered unsuitable for military or naval use. A new navigational system, TACAN, was therefore developed by the military and naval forces to more readily lend itself to military and naval requirements. As a result, the FAA has been in the process of integrating TACAN facilities with the civil VOR/DME program. Although the theoretical, or technical principles of operation of TACAN equipment are quite different from those of VOR/DME facilities, the end result, as far as the navigating pilot is concerned, is the same. These integrated facilities are called VORTAC's.

b. TACAN ground equipment consists of either a fixed or mobile transmitting unit. The airborne unit in conjunction with the ground unit reduces the transmitted signal to a visual presentation of both azimuth and distance information. TACAN is a pulse system and operates in the UHF band of frequencies. Its use requires TACAN airborne equipment and does not operate through conventional VOR equipment.

6. VHF OMNI-DIRECTIONAL RANGE/TACTICAL AIR NAVIGATION (VORTAC)

a. A VORTAC is a facility consisting of two components, VOR and TACAN, which provides three individual services: VOR azimuth, TACAN azimuth and TACAN distance (DME) at one site. Although consisting of more than one component, incorporating more than one operating frequency, and using more than one antenna system, a VORTAC is considered to be a unified navigational aid. Both components of a VORTAC are envisioned as operating simultaneously and providing the three services at all times.

b. Transmitted signals of VOR and TACAN are each identified by three-letter code transmission and are interlocked so that pilots using VOR azimuth with TACAN distance can be assured that both signals being received are definitely from the same ground station. The frequency channels of the VOR and the TACAN at each VORTAC facility are "paired" in accordance with a national plan to simplify airborne operation.

7. DISTANCE MEASURING EQUIPMENT (DME)

a. In the operation of DME, paired pulses at a specific spacing are sent out from the aircraft (this is the interrogation) and are received at the ground station. The ground

station (transponder) then transmits paired pulses back to the aircraft at the same pulse spacing but on a different frequency. The time required for the round trip of this signal exchange is measured in the airborne DME unit and is translated into distance (Nautical Miles) from the aircraft to the ground station.

b. Operating on the line-of-sight principle, DME furnishes distance information with a very high degree of accuracy. Reliable signals may be received at distances up to 199 NM at line-of-sight altitude with an accuracy of better than 1/2 mile or 3 percent of the distance, whichever is greater. Distance information received from DME equipment is SLANT RANGE distance and not actual horizontal distance.

c. DME operates on frequencies in the UHF spectrum between 962 MHz and 1213 MHz. Aircraft equipped with TACAN equipment will receive distance information from a VORTAC automatically, while aircraft equipped with VOR must have a separate DME airborne unit.

d. VOR/DME, VORTAC, ILS/DME, and LOC/DME navigation facilities established by the FAA provide course and distance information from collocated components under a frequency pairing plan. Aircraft receiving equipment which provides for automatic DME selection assures reception of azimuth and distance information from a common source when designated VOR/DME, VORTAC, ILS/DME, and LOC/DME are selected.

e. Due to the limited number of available frequencies, assignment of paired frequencies is required for certain military noncollocated VOR and TACAN facilities which serve the same area but which may be separated by distances up to a few miles. The military is presently undergoing a program to collocate VOR and TACAN facilities or to assign nonpaired frequencies to those that cannot be collocated.

f. VOR/DME, VORTAC, ILS/DME, and LOC/DME facilities are identified by synchronized identifications which are transmitted on a time share basis. The VOR or localizer portion of the facility is identified by a coded tone modulated at 1020 Hz or a combination of code and voice. The TACAN or DME is identified by a coded tone modulated at 1350 Hz. The DME or TACAN coded identification is transmitted one time for each three or four times that the VOR or localizer coded identification is transmitted. When either the VOR or the DME is inoperative, it is important to recognize which identifier is retained for the operative facility. A single coded identification with a repetition interval of approximately 30 seconds indicates that the DME is operative.

g. Aircraft equipment which provides for automatic DME selection assures reception of azimuth and distance information from a common source when designated VOR/DME, VORTAC and ILS/DME navigation facilities are selected. Pilots are cautioned to disregard any distance displays from automatically selected DME equipment when VOR or ILS facilities, which do not have the DME feature installed, are being used for position determination.

8—9. RESERVED

10. NAVAID SERVICE VOLUMES

a. Most air navigation radio aids which provide positive course guidance have a designated standard service volume (SSV). The SSV defines the reception limits of unrestricted NAVAIDS which are usable for random/unpublished route navigation.

b. A NAVAID will be classified as restricted if it does not conform to flight inspection signal strength and course quality standards throughout the published SSV. However, the NAVAID should not be considered usable at altitudes below that which could be flown while operating under random route IFR conditions (FAR 91.119), even though these altitudes may lie within the designated SSV. Service volume restrictions are first published in the Notices to Airman (NOTAM) and then with the alphabetical listing of the NAVAID's in the Airport/Facility Directory.

c. Standard Service Volume limitations do not apply to published IFR routes or procedures.

d. VOR/DME/TACAN STANDARD SERVICE VOLUMES (SSV)

Standard service volumes (SSVs) are graphically shown in Figures 10-1 through 10-5. The SSV of a station is indicated by using the class designator as a prefix to the station type designation.

EXAMPLE:

TVOR, LDME, and HVORTAC.

Within 25 NM, the bottom of the T service volume is defined by the curve in Figure 10-4. Within 40 NM, the bottoms of the L and H service volumes are defined by the curve in Figure 10-5.

SSV CLASS DESIGNATOR	ALTITUDE AND RANGE BOUNDARIES
T (Terminal)	From 1000 feet above ground level (AGL) up to and including 12,000 feet AGL at radial distances out to 25 NM. See Figures 10-3 and 10-4.
L (Low Altitude)	From 1000 feet AGL up to and including 18,000 feet AGL at radial distances out to 40 NM. See Figures 10-2 and 10-5.
H (High Altitude)	From 1000 feet AGL up to and including 14,500 feet AGL at radial distances out to 40 NM. From 14,500 feet AGL up to and including 60,000 feet at radial distances out to 100 NM. From 18,000 feet AGL up to and including 45,000 feet AGL at radial distances out to 130 NM. See Figures 10-1 and 10-5.

FIGURE 10-1. STANDARD HIGH ALTITUDE SERVICE VOLUME

(refer to FIGURE 5 for altitudes below 1000 feet)

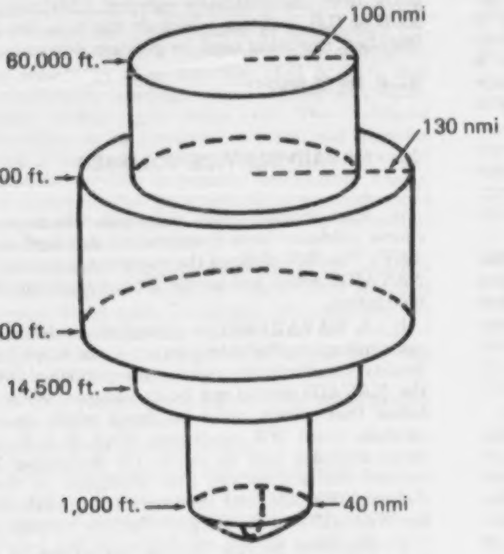
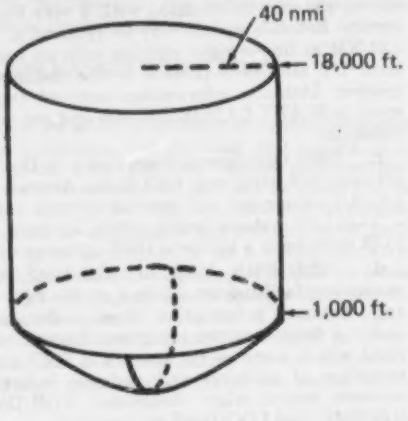

100 nmi
60,000 ft.
130 nmi
45,000 ft.
8,000 ft.
14,500 ft.
1,000 ft.
40 nmi

FIGURE 10-2. STANDARD LOW ALTITUDE SERVICE VOLUME

(refer to FIGURE 5 for altitudes below 1000 feet)


40 nmi
18,000 ft.
1,000 ft.

NOTE: All elevations shown are with respect to the station's site elevation (AGL). Coverage is not available in a cone of airspace directly above the facility.

FIGURE 10-3. STANDARD TERMINAL SERVICE VOLUME

(refer to FIGURE 4 for altitudes below 1000 feet)

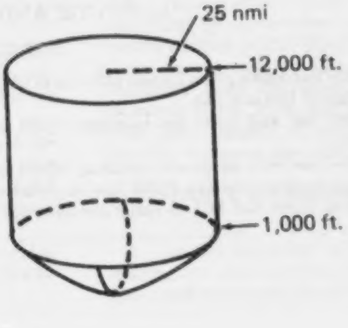

25 nmi
12,000 ft.
1,000 ft.

FIGURE 10-4. DEFINITION OF THE LOWER EDGE OF THE STANDARD T (TERMINAL) SERVICE VOLUME

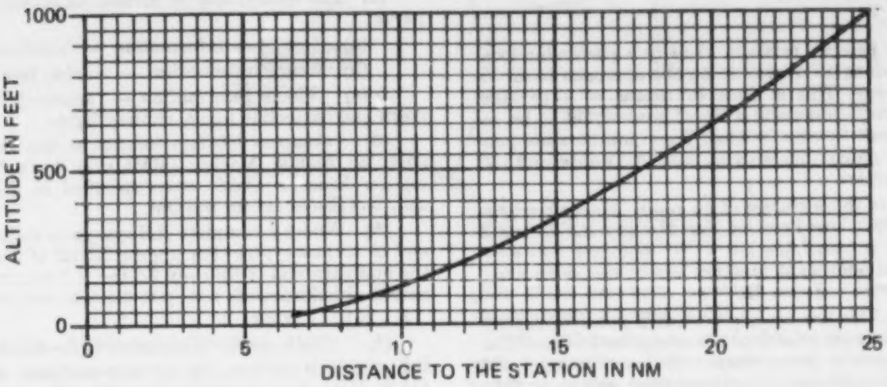
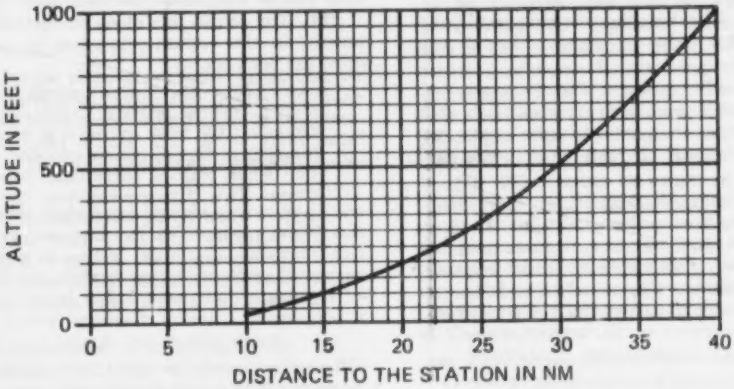


FIGURE 10-5. DEFINITION OF THE LOWER EDGE OF THE STANDARD H (HIGH) AND L (LOW) SERVICE VOLUMES



e. NONDIRECTIONAL RADIO BEACON (NDB)

NDBs are classified according to their intended use. The ranges of NDB service volumes are shown below. The distances (radius) are the same at all altitudes.

CLASS	DISTANCE (RADIUS)
Compass Locator	15 NM
MH	25 NM
H	50 NM*
HH	75 NM

* Service ranges of individual facilities may be less than 50 nautical miles (NM). Restrictions to service volumes are first published in the Notice to Airmen and then with the alphabetical listing of the NAVAID in the Airport/Facility Directory.

11. MARKER BEACON

a. Marker beacons serve to identify a particular location in space along an airway or on the approach to an instrument runway. This is done by means of a 75 MHz transmitter which transmits a directional signal to be received by aircraft flying overhead. These markers are generally used in conjunction with en route NAVAIDs and ILS as point designators.

b. There are three classes of en route marker beacons: Fan Marker (FM), Low Powered Fan Markers (LFM) and Z Markers. They transmit the letter "R" (dot dash dot) identification, or (if additional markers are in the same area) the letter "K," "P," "X," or "Z."

(1) Class FMs are used to provide a positive identification of positions at definite points along the airways. The transmitters have a power output of approximately 100 watts. Two types of antenna array are used with class FMs.

(a) The first type used, and generally referred to as the standard type, produces an elliptical shaped pattern, which, at an elevation of 1,000 feet above the station, is about 4 NM wide and 12 NM long. At 10,000 feet the pattern widens to about 12 NM wide and 35 NM long.

(b) The second array produces a dumbbell or boneshaped pattern, which, at the "handle", is about three miles wide at 1,000 feet. The boneshaped marker is preferred at approach control locations where "timed" approaches are used.

(2) The class LFM or low powered FMs have a rated power output of 5 watts. The antenna array produces a circular pattern which appears elongated at right angles to the airway due to the directional characteristics of the aircraft receiving antenna.

(3) The Station Location, or Z-Marker, was developed to meet the need for a positive position indicator for aircraft operating under instrument flight conditions to show the pilot when he was passing directly over a low frequency navigational aid. The marker consists of a 5 watt transmitter and a directional antenna array which is located on the range plot between the towers or the loop antennas.

NOTE— Information concerning marker beacons which are used in conjunction with ILS systems is included in PARA. 12 - INSTRUMENT LANDING SYSTEMS (ILS).

12. INSTRUMENT LANDING SYSTEM (ILS)

a. GENERAL

(1) The ILS is designed to provide an approach path for exact alignment and descent of an aircraft on final approach to a runway.

(2) The ground equipment consists of two highly directional transmitting systems and, along the approach, three (or fewer) marker beacons. The directional transmitters are known as the localizer and glide slope transmitters.

(3) The system may be divided functionally into three parts:

(a) **Guidance information —** localizer, glide slope

(b) **Range information —** marker beacon, DME

(c) **Visual information —** approach lights, touchdown and centerline lights, runway lights

(4) Compass locators located at the Outer Marker (OM) or Middle Marker (MM) may be substituted for marker beacons. DME, when specified in the procedure, may be substituted for the OM.

(5) Where a complete ILS system is installed on each end of a runway; (i.e. the approach end of Runway 4 and the approach end of Runway 22) the ILS systems are not in service simultaneously.

b. LOCALIZER

(1) The localizer transmitter operates on one of 40 ILS channels within the frequency range of 108.10 to 111.95 MHz. Signals provide the pilot with course guidance to the runway centerline.

(2) The approach course of the localizer is called the front course and is used with other functional parts, e.g., glide slope, marker beacons, etc. The localizer signal is transmitted at the far end of the runway. It is adjusted for a course width of (full scale fly-left to a full scale fly-right) of 700 feet at the runway threshold.

(3) The course line along the extended centerline of a runway, in the opposite direction to the front course is called the back course.

> *CAUTION:* Unless the aircraft's ILS equipment includes reverse sensing capability, when flying inbound on the back course it is necessary to steer the aircraft in the direction opposite the needle deflection when making corrections from off-course to on-course. This "flying away from the needle" is also required when flying outbound on the front course of the localizer. DO NOT USE BACK COURSE SIGNALS for approach unless a BACK COURSE APPROACH PROCEDURE is published for that particular runway and the approach is authorized by ATC.

(4) Identification is in International Morse Code and consists of a three-letter identifier preceded by the letter I (..) transmitted on the localizer frequency.

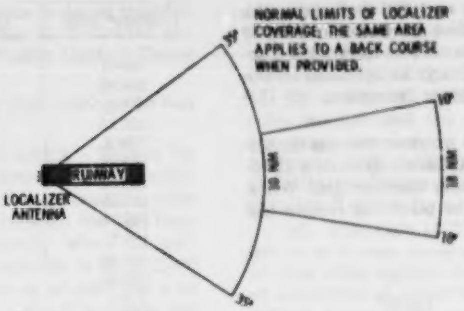
EXAMPLE:

I-DIA

(5) The localizer provides course guidance throughout the descent path to the runway threshold from a distance of 18 NM from the antenna between an altitude of 1,000 feet above the highest terrain along the course line and 4,500 feet above the elevation of the antenna site. Proper off-course indications are provided throughout the following angular areas of the operational service volume:

(a) To 10 degrees either side of the course along a radius of 18 NM from the antenna, and

(b) From 10 to 35 degrees either side of the course along a radius of 10 NM.


NORMAL LIMITS OF LOCALIZER COVERAGE; THE SAME AREA APPLIES TO A BACK COURSE WHEN PROVIDED.
35°
10°
10 NM
18 NM
10°
35°
RUNWAY
LOCALIZER ANTENNA

(6) Unreliable signals may be received outside these areas.

c. LOCALIZER—TYPE DIRECTIONAL AID

(1) The Localizer-type Directional Aid (LDA) is of comparable use and accuracy to a localizer but is not part of a complete ILS. The LDA course usually provides a more precise approach course than the similar Simplified Directional Facility (SDF) installation, which may have a course width of 6 or 12 degrees. The LDA is not aligned with the runway. Straight-in minima may be published where alignment does not exceed 30 degrees between the course and runway. Circling minima only are published where this alignment exceeds 30 degrees.

d. GLIDE SLOPE/GLIDE PATH

(1) The UHF glide slope transmitter, operating on one of the 40 ILS channels within the frequency range 329.15 MHz, to 335.00 MHz radiates its signals in the direction of the localizer front course. The term "glide path" means that portion of the glide slope that intersects the localizer.

CAUTION: False glide slope signals may exist in the area of the localizer back course approach which can cause the glide slope flag alarm to disappear and present unreliable glide slope information. Disregard all glide slope signal indications when making a localizer back course approach unless a glide slope is specified on the approach and landing chart.

(2) The glide slope transmitter is located between 750 feet and 1,250 feet from the approach end of the runway (down the runway) and offset 250 to 650 feet from the runway centerline. It transmits a glide path beam 1.4 degrees wide. The signal provides descent information for navigation down to the lowest authorized decision height (DH) specified in the approved ILS approach procedure. The glidepath may not be suitable for navigation below the lowest authorized DH and any reference to glidepath indications below that height must be supplemented by visual reference to the runway environment. Glidepaths with no published DH are usable to runway threshold.

(3) The glide path projection angle is normally adjusted to 3 degrees above horizontal so that it intersects the MM at about 200 feet and the OM at about 1,400 feet above the runway elevation. The glide slope is normally usable to the distance of 10 NM. However, at some locations, the glide slope has been certified for an extended service volume which exceeds 10 NM.

(4) Pilots must be alert when approaching the glidepath interception. False courses and reverse sensing will occur at angles considerably greater than the published path.

(5) Make every effort to remain on the indicated glide path (reference: FAR 91.87(d)(2)). Exercise caution: avoid flying below the glide path to assure obstacle/terrain clearance is maintained.

(6) The published glide slope threshold crossing height (TCH) *DOES NOT* represent the height of the actual glide path on course indication above the runway threshold. It is used as a reference for planning purposes which represents the height above the runway threshold that an aircraft's glide slope antenna should be, if that aircraft remains on a trajectory formed by the four-mile-to-middle marker glidepath segment.

(7) Pilots must be aware of the vertical height between the aircraft's glide slope antenna and the main gear in the landing configuration and, at the DH, plan to adjust the descent angle accordingly if the published TCH indicates the wheel crossing height over the runway threshold may not be satisfactory. Tests indicate a comfortable wheel crossing height is approximately 20 to 30 feet, depending on the type of aircraft.

e. DISTANCE MEASURING EQUIPMENT (DME)

(1) When installed with the ILS and specified in the approach procedure, DME may be used:

(a) In lieu of the OM.

(b) As a back course (BC) final approach fix (FAF).

(c) To establish other fixes on the localizer course.

(2) In some cases, DME from a separate facility may be used within Terminal Instrument Procedures (TERPS) limitations:

(a) To provide ARC initial approach segments.

(b) As a FAF for BC approaches.

(c) As a substitute for the OM.

f. MARKER BEACON

(1) ILS marker beacons have a rated power output of 3 watts or less and an antenna array designed to produce a elliptical pattern with dimensions, at 1,000 feet above the antenna, of approximately 2,400 feet in width and 4,200 feet in length. Airborne marker beacon receivers with a selective sensitivity feature should always be operated in the "low" sensitivity position for proper reception of ILS marker beacons.

(2) Ordinarily, there are two marker beacons associated with an ILS, the OM and MM. Locatons with a Category II and III ILS also have an inner marker (IM). When an aircraft passes over a marker, the pilot will receive the following indications:

MARKER	CODE	LIGHT
OM	— — —	BLUE
MM	○ — ○ —	AMBER
IM	○ ○ ○ ○	WHITE
BC	○ ○ ○ ○	WHITE

(a) The OM normally indicates a position at which an aircraft at the appropriate altitude on the localizer course will intercept the ILS glide path.

(b) The MM indicates a position approximately 3,500 feet from the landing threshold. This is also the position where an aircraft on the glide path will be at an altitude of approximately 200 feet above the elevation of the touchdown zone.

(c) The inner marker (IM) will indicate a point at which an aircraft is at a designated decision height (DH) on the glide path between the MM and landing threshold.

(3) A back course marker normally indicates the ILS back course final approach fix where approach descent is commenced.

g. COMPASS LOCATOR

(1) Compass locator transmitters are often situated at the MM and OM sites. The transmitters have a power of less than 25 watts, a range of at least 15 miles and operate between 190 and 535 kHz. At some locations, higher powered radio beacons, up to 400 watts, are used as OM compass locators. These generally carry Transcribed Weather Broadcast (TWEB) information.

(2) Compass locators transmit two letter identification groups. The outer locator transmits the first two letters of the localizer identification group, and the middle locator transmits the last two letters of the localizer identification group.

h. ILS FREQUENCY

(1) The following frequency pairs are allocated for ILS.

Localizer MHz	Glide Slope
108.10	334.70
108.15	334.55
108.3	334.10
108.35	333.95
108.5	329.90
108.55	329.75
108.7	330.50
108.75	330.35
108.9	329.30
108.95	329.15
109.1	331.40
109.15	331.25
109.3	332.00
109.35	331.85
109.50	332.60
109.55	332.45
109.70	333.20
109.75	333.05
109.90	333.80
109.95	333.65
110.1	334.40
110.15	334.25
110.3	335.00
110.35	334.85
110.5	329.60
110.55	329.45
110.70	330.20
110.75	330.05
110.90	330.80
110.95	330.65
111.10	331.70
111.15	331.55
111.30	332.30
111.35	332.15
111.50	332.9
111.55	332.75
111.70	333.5
111.75	333.35
111.90	331.1
111.95	330.95

i. ILS MINIMUMS

(1) The lowest authorized ILS minimums, with all required ground and airborne systems components operative, are

(a) Category I - Decision Height (DH) 200 feet and Runway Visual Range (RVR) 2,400 feet (with touchdown zone and centerline lighting, RVR 1800 Category A, B, C; RVR 2000 Category D).

(b) Category II - DH 100 feet and RVR 1,200 feet.

(c) Category IIIA - RVR 700 feet.

NOTE— Special authorization and equipment are required for Category II and IIIA.

j. INOPERATIVE ILS COMPONENTS

(1) Inoperative localizer: When the localizer fails, an ILS approach is not authorized.

(2) Inoperative glide slope: When the glide slope fails, the ILS reverts to a nonprecision localizer approach.

NOTE— Refer to the Inoperative Component Table in the U.S. Government IAPs publications, Supplementary Information Section, for adjustments to minimums due to inoperative airborne or ground system equipment.

k. ILS COURSE DISTORTION

(1) All pilots should be aware that disturbances to ILS localizer and glide slope courses may occur when surface vehicles or aircraft are operated near the localizer or glide slope antennas. Most ILS installations are subject to signal interference by either surface vehicles, aircraft or both. ILS CRITICAL AREAS are established near each localizer and glide slope antenna.

(2) ATC issues control instructions to avoid interfering operations within ILS critical areas at controlled airports during the hours the Airport Traffic Control Tower (ATCT) is in operations as follows:

(a) Weather Conditions - Less than ceiling 800 feet and/or visibility 2 miles.

(i) LOCALIZER CRITICAL AREA - Except for aircraft that land, exit a runway, depart or miss approach, vehicles and aircraft are not authorized in or over the critical area when an arriving aircraft is between the ILS final approach fix and the airport. Additionally, when the ceiling is less than 200 feet and/or the visibility is RVR 2,000 or less, vehicle and aircraft operations in or over the area are not authorized when an arriving aircraft is inside the ILS MM.

(ii) GLIDE SLOPE CRITICAL AREA - Vehicles and aircraft are not authorized in the area when an arriving aircraft is between the ILS final approach fix and the airport unless the aircraft has reported the airport in sight and is circling or side stepping to land on a runway other than the ILS runway.

(3) Aircraft holding below 5000 feet between the outer marker and the airport may cause localizer signal variations for aircraft conducting the ILS Approach. Accordingly, such holding is not authorized when weather or visibility conditions are less than ceiling 800 feet and/or visibility 2 miles.

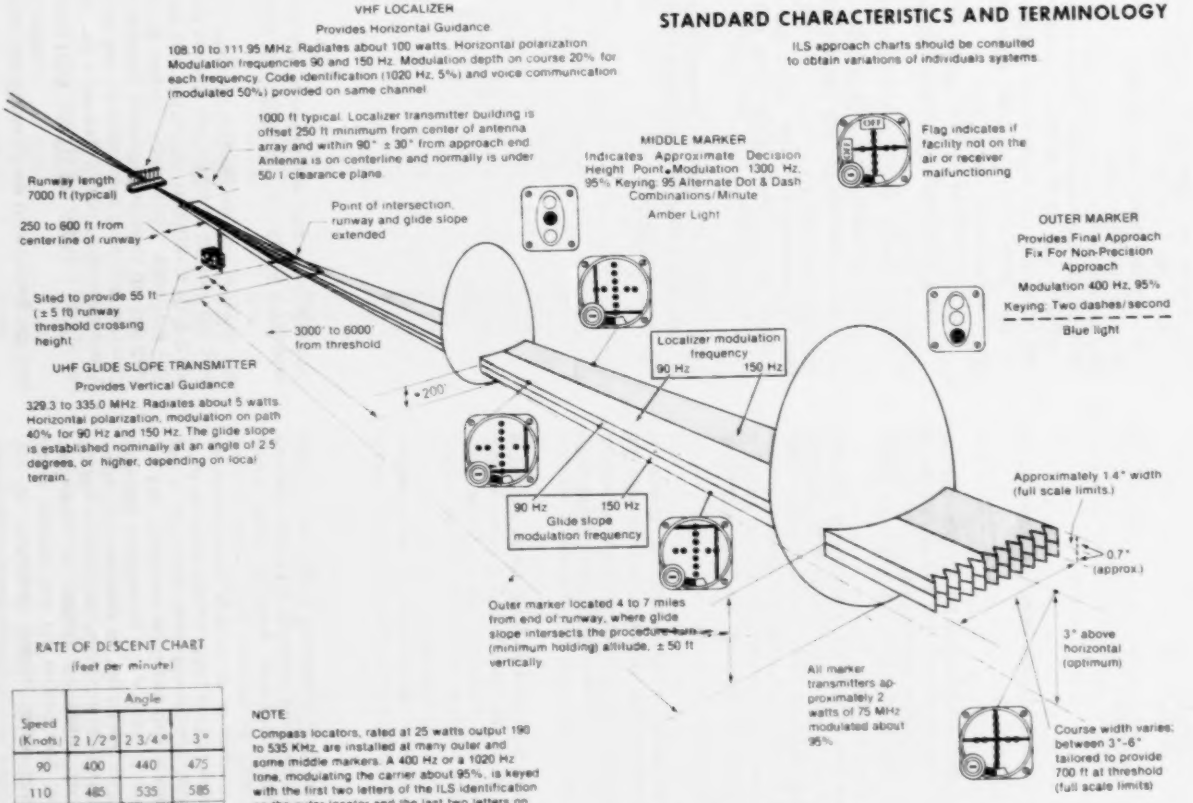
(4) Pilots are cautioned that vehicular traffic not subject to ATC may cause momentary deviation to ILS course or glide slope signals. Also, critical areas are not protected at uncontrolled airports or at airports with an operating control tower when weather or visibility conditions are above those requiring protective measures. Aircraft conducting coupled or autoland operations should be especially alert in monitoring automatic flight control systems.

ILS

[FAA INSTRUMENT LANDING SYSTEM]

STANDARD CHARACTERISTICS AND TERMINOLOGY

ILS approach charts should be consulted to obtain variations of individuals systems.


VHF LOCALIZER
Provides Horizontal Guidance
108.10 to 111.95 MHz. Radiates about 100 watts. Horizontal polarization. Modulation frequencies 90 and 150 Hz. Modulation depth on course 20% for each frequency. Code identification (1020 Hz, 5%) and voice communication (modulated 50%) provided on same channel.
1000 ft typical. Localizer transmitter building is offset 250 ft minimum from center of antenna array and within 90° ± 30° from approach end. Antenna is on centerline and normally is under 50/1 clearance plane.
Runway length 7000 ft (typical)
250 to 600 ft from centerline of runway
Point of intersection, runway and glide slope extended
Sited to provide 55 ft (± 5 ft) runway threshold crossing height
3000' to 6000' from threshold
*200'
UHF GLIDE SLOPE TRANSMITTER
Provides Vertical Guidance
329.3 to 335.0 MHz. Radiates about 5 watts. Horizontal polarization, modulation on path 40% for 90 Hz and 150 Hz. The glide slope is established nominally at an angle of 2.5 degrees, or higher, depending on local terrain.
MIDDLE MARKER
Indicates Approximate Decision Height Point. Modulation 1300 Hz, 95% Keying: 95 Alternate Dot & Dash Combinations/Minute
Amber Light
OFF
OFF
Flag indicates if facility not on the air or receiver malfunctioning
OUTER MARKER
Provides Final Approach Fix For Non-Precision Approach
Modulation 400 Hz, 95%
Keying: Two dashes/second
Blue light
Localizer modulation frequency
90 Hz
150 Hz
90 Hz
150 Hz
Glide slope modulation frequency
Approximately 1.4° width (full scale limits.)
0.7° (approx.)
Outer marker located 4 to 7 miles from end of runway, where glide slope intersects the procedure turn (minimum holding) altitude, ± 50 ft vertically
3° above horizontal (optimum)
All marker transmitters approximately 2 watts of 75 MHz modulated about 95%
Course width varies; between 3°-6° tailored to provide 700 ft at threshold (full scale limits)

RATE OF DESCENT CHART
(feet per minute)

Speed (Knots)	Angle		
	2 1/2°*	2 3/4°*	3°
90	400	440	475
110	485	535	585
130	575	630	690
150	665	730	795
160	707	778	849

NOTE:
Compass locators, rated at 25 watts output 190 to 535 KHz, are installed at many outer and some middle markers. A 400 Hz or a 1020 Hz tone, modulating the carrier about 95%, is keyed with the first two letters of the ILS identification on the outer locator and the last two letters on the middle locator. At some locators, simultaneous voice transmissions from the control tower are provided, with appropriate reduction in identification percentage.

* Figures marked with asterisk are typical. Actual figures vary with deviations in distances to markers, glide angles and localizer widths.

(b) Weather Conditions - At or above ceiling 800 feet and/or visibility 2 miles.

(i) No critical area protective action is provided under these conditions

(ii) If an aircraft advises the TOWER that an AUTOLAND or COUPLED approach will be conducted, an advisory will be promptly issued if a vehicle or aircraft will be in or over a critical area when the arriving aircraft is inside the ILS MM.

EXAMPLE:

GLIDE SLOPE SIGNAL NOT PROTECTED.

13. SIMPLIFIED DIRECTIONAL FACILITY (SDF)

a. The SDF provides a final approach course similar to that of the ILS localizer. It does not provide glide slope information. A clear understanding of the ILS localizer and the additional factors listed below completely describe the operational characteristics and use of the SDF.

b. The SDF transmits signals within the range of 108.10 to 111.95 MHz.

c. The approach techniques and procedures used in an SDF instrument approach are essentially the same as those employed in executing a standard localizer approach except the SDF course may not be aligned with the runway and the course may be wider, resulting in less precision.

d. Usable off-course indications are limited to 35 degrees either side of the course centerline. Instrument indications received beyond 35 degrees should be disregarded.

e. The SDF antenna may be offset from the runway centerline. Because of this, the angle of convergence between the final approach course and the runway bearing should be determined by reference to the instrument approach procedure chart. This angle is generally not more than 3 degrees. However, it should be noted that inasmuch as the approach course originates at the antenna site, an approach which is continued beyond the runway threshold will lead the aircraft to the SDF offset position rather than along the runway centerline.

f. The SDF signal is fixed at either 6 degrees or 12 degrees as necessary to provide maximum flyability and optimum course quality.

g. Identification consists of a three-letter identifier transmitted in Morse Code on the SDF frequency. The appropriate instrument approach chart will indicate the identifier used at a particular airport.

14. MICROWAVE LANDING SYSTEM (MLS)

a. GENERAL

(1) The MLS provides precision navigation guidance for exact alignment and descent of aircraft on approach to and landing on a runway. It provides azimuth and elevation angle guidance and range information—all of which is interpreted by the aircraft receiver to determine the aircraft's position. The MLS azimuth transmitter is located about 1,000 feet beyond the stop end of the runway, and the MLS elevation transmitter is located to the side of the runway near the approach threshold. The Precision DME, which provides range information, is normally collocated with the azimuth transmitter.

(2) Both lateral and vertical MLS guidance may be displayed on conventional course deviation indicators or incorporated into multipurpose cockpit displays. Range information can be displayed by conventional DME indicators and also incorporated into multipurpose displays.

(3) The MLS will initially supplement and eventually replace ILS as the standard landing system in the United States for both civil and military use—and also for international civil aviation. The MLS transition plan assures duplicate ILS and MLS facilities where needed to protect current users of ILS. At international airports ILS service is protected to the year 1995.

(4) The system may be divided functionally into five parts:

(a) Approach azimuth angle guidance.

(b) Back azimuth angle guidance.

(c) Approach elevation angle guidance.

(d) Range guidance.

(e) Data communications.

(5) The *standard configuration* of the MLS ground equipment includes:

(a) An approach azimuth station to perform functions (a) and (e) above. In addition to providing azimuth navigation guidance, the azimuth station also transmits basic data which consists of information that is associated directly with the operation of the landing system, as well as advisory data on the performance level of the ground equipment.

(b) An approach elevation station to perform function (c) above.

(c) Precision Distance Measuring Equipment (DME/P) to perform function (d) above. The DME/P provides continuous range information that is compatible with standard navigation DME but has improved accuracy and additional channel capabilities.

(6) MLS Expansion Capabilities — The standard MLS configuration can be expanded by addition of one or more of the following functions or characteristic improvements:

(a) Back azimuth — To provide lateral guidance for missed approach and departure navigation.

(b) Auxiliary data transmissions — To provide *additional* data, including refined airborne positioning, meteorological information, runway status, and other supplementary information.

(c) Larger proportional guidance.

(7) MLS identification is a four-character alphabetic designation starting with the letter M. This designation is transmitted in International Morse Code at least six times per minute by the approach azimuth (and back azimuth) ground equipment.

b. APPROACH AZIMUTH GUIDANCE

(1) The azimuth station transmits MLS angle (and data) on one of the 200 MLS channels within the C-band frequency range of 5031 to 5091 MHz. See Table 1 for MLS angle and data channeling, and Table 2 for the DME.

(2) The equipment is normally located about 1,000 feet beyond the stop end of the runway, but there is considerable flexibility in selecting sites. For example, for heliport operations the azimuth transmitter can be collocated with the elevation transmitter.

(3) The azimuth coverage (see Figure 1) extends:

(a) Laterally, at least 40 degrees on either side of the runway.

(b) In elevation, up to an angle of 15 degrees — and to at least 20,000 feet.

(c) In range, to a distance of at least 20 NM.

c. BACK AZIMUTH GUIDANCE (See Figure 1)

(1) The back azimuth transmitter is essentially the same as the approach azimuth transmitter. However, the equipment transmits at a somewhat lower data rate because the guidance accuracy requirements are not as stringent as for the landing approach. The equipment operates on the same frequency as the approach azimuth but at a different time in the transmission sequence.

(2) The equipment is normally located about 1,000 feet in front of the approach end of the runway. On runways that have MLS service on both ends (e.g., Runway 9 and 27), the azimuth equipment can be switched in their operation from the approach azimuth to the back azimuth and vice versa, and thereby reduce the amount of equipment required.

(3) The back azimuth provides coverage as follows:

(a) Laterally, at least 40 degrees on either side of the runway.

(b) In elevation, up to an angle of 15 degrees.

(c) In range, to a distance of at least 7 NM from the runway stop end.

NOTE— The actual coverage will normally be the same as for the approach azimuth.

d. ELEVATION GUIDANCE (See Figure 1)

(1) The elevation station transmits its guidance signals on the same carrier frequency as the azimuth station. A single frequency is time-shared between all angle and data functions.

(2) The elevation transmitter is normally located about 400 feet on either side of the runway between runway threshold and the touchdown zone.

(3) Elevation coverage is provided in the approach region throughout the same volume of airspace as the azimuth guidance signals, namely:

(a) In elevation, to at least +15 degrees.

(b) Laterally, 40 degrees on either side of the runway.

(c) In range, to a distance of at least 20 NM.

e. RANGE GUIDANCE

(1) The MLS Precision Distance Measuring Equipment (DME/P) is the same in function as the navigation DME described in PARA. 7, but there are some technical differences. It consists of a beacon transponder that operates in the frequency band 962 to 1105 MHz. It responds to a beacon interrogation made by an aircraft interrogator. The main change with the MLS DME/P is that the accuracy has been improved so as to be consistent with the accuracy provided by the MLS azimuth and elevation stations.

(2) In operation, a DME/P channel will be paired with the azimuth and elevation channel when the selection of a particular MLS is made by the pilot. A complete listing of the 200 paired channels of the DME/P with the angle functions is contained in FAA Standard 022 (MLS Interoperability and Performance Requirements). For illustrative purposes the first page is shown in Table 2.

(3) The DME/P is an integral part of the MLS and will be installed at all MLS facilities unless a waiver is obtained. It is intended that this will occur infrequently — and only at outlying, low density airports where marker beacons or compass locators are already in place at the runway to be served.

f. DATA COMMUNICATIONS

(1) The data transmission can include both basic and auxiliary data words. All MLS facilities will transmit basic data. In the future some airports, including most high density airports, will also transmit auxiliary data.

(2) Coverage limits — MLS data are transmitted throughout the azimuth (and back azimuth when provided) coverage sectors.

(3) Basic data content — Representative data include:

(a) Station identification.

(b) Surveyed locations of azimuth, elevation and DME/P stations (for MLS receiver processing functions).

(c) Ground equipment performance level.

(d) DME/P channel and status.

(4) Auxiliary data content — Representative data include:

(a) 3-D locations of MLS equipment.

(b) Waypoint coordinates.

(c) Runway conditions.

(d) Weather (e.g., RVR, ceiling, altimeter setting, wind, wake vortex, wind shear).

g. SUMMARY

(1) **Accuracy.** The MLS provides precision three-dimensional navigation guidance — guidance that is accurate enough for all approach and landing maneuvers.

(2) **Coverage.** The above accuracy is provided throughout the coverage volumes shown in Figure 1.

(3) **Environment.** The system has low susceptibility to interference from weather conditions and airport ground traffic — and is easy to site on the airport.

(4) **Channels.** MLS has 200 channels — enough for any foreseeable future need.

(5) **Data.** The MLS transmits ground-air data messages associated with system operation.

(6) **Range information.** Continuous range information is provided with an accuracy of about 100 feet.

(7) **Operational flexibility.** The MLS has the capability to fulfill a variety of needs in the transition, approach, landing, missed approach and departure phases of flight. For example: Curved and segmented approaches; selectable glide path angles; accurate 3-D positioning of the aircraft in space; and the establishment of boundaries to ensure clearance from obstructions in the terminal area. While many of these capabilities are available to any MLS-equipped aircraft, the more sophisticated capabilities (such as curved and segmented approaches) are dependent upon the particular capabilities of the airborne equipment.

Table 1. MLS Channeling

(Azimuth, Elevation, & Dat

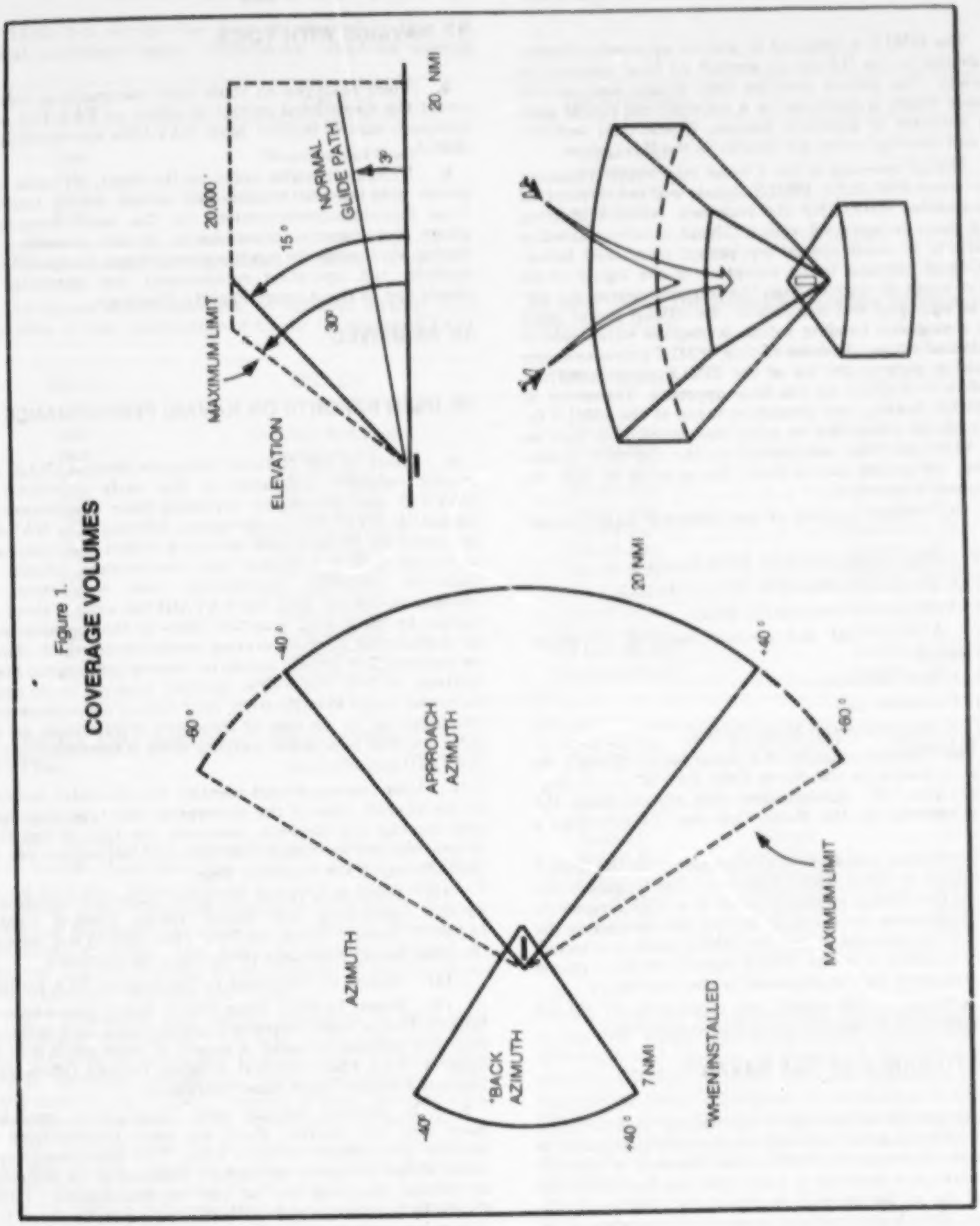
CHANNEL NUMBER	FREQUENCY (MHz)	CHANNEL NUMBER	FREQUENCY (MHz)	CHANNEL NUMBER	FREQUENCY (MHz)	CHANNEL NUMBER	FREQUENCY (MHz)	CHANNEL NUMBER	FREQUENCY (MHz)
500	5031.0	540	5043.0	580	5055.0	620	5067.0	660	5079.0
501	5031.3	.	.	.	.	.	.	.	.
502	5031.6	.	.	.	.	.	.	.	.
503	5031.9	.	.	.	.	.	.	.	.
504	5032.2	.	.	.	.	.	.	.	.
505	5032.5	545	5044.5	585	5056.5	625	5068.5	665	5080.5
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
510	5034.0	550	5046.0	590	5058.0	630	5070.0	670	5082.0
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
515	5035.5	555	5047.5	595	5059.5	635	5071.5	675	5083.5
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
520	5037.0	560	5049.0	600	5061.0	640	5073.0	680	5085.0
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
525	5038.5	565	5050.5	605	5062.5	645	5074.5	685	5086.5
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
530	5040.0	570	5052.0	610	5064.0	650	5076.0	690	5088.0
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
535	5041.5	575	5053.5	615	5065.5	655	5077.5	695	5089.5
.	.	.	.	.	.	.	.	696	5089.8
.	.	.	.	.	.	.	.	697	5090.1
.	.	.	.	.	.	.	.	698	5090.4
.	.	.	.	.	.	.	.	699	5090.7

Table 2. DME/P Channels, Frequencies, and Pairings

DME CHANNEL (NUMBER)	VHF CHANNEL (MHz)	C-BAND CHANNEL (MHz)	ANGLE CHANNEL (NUMBER)	INTERROGATOR FREQUENCY (MHz)	NON-PRECISION INTERROGATOR PULSE CODE (USEC)	PRECISION INTERROGATOR PULSE CODE (USEC)	TRANSPONDER FREQUENCY (MHz)	TRANSPONDER PULSE CODE (USEC)
1X				1025	12		962	12
1Y				1025	36		1088	30
2X				1026	12		963	12
2Y				1026	36		1089	30
3X				1027	12		964	12
3Y				1027	36		1090	30
4X				1028	12		965	12
4Y				1028	36		1091	30
5X				1029	12		966	12
5Y				1029	36		1092	30
6X				1030	12		967	12
6Y				1030	36		1093	30
7X				1031	12		968	12
7Y				1031	36		1094	30
8X				1032	12		969	12
8Y				1032	36		1095	30
9X				1033	12		970	12
9Y				1033	36		1096	30
10X				1034	12		971	12
10Y				1034	36		1097	30
11X				1035	12		972	12
11Y				1035	36		1098	30
12X				1036	12		973	12
12Y				1036	36		1099	30
13X				1037	12		974	12
13Y				1037	36		1100	30
14X				1038	12		975	12
14Y				1038	36		1101	30
15X				1039	12		976	12
15Y				1039	36		1102	30
16X				1040	12		977	12
16Y				1040	36		1103	30
17X	108.00	-	-	1041	12	-	978	12
17Y	108.05	5043.00	540	1041	36	42	1104	30
17Z	-	5043.30	541	1041	21	27	1104	15
18X	108.10	5031.00	500	1042	12	18	979	12
18W	-	5031.30	501	1042	24	33	979	24
18Y	108.15	5043.60	542	1042	36	42	1105	30
18Z	-	5043.90	543	1042	21	27	1105	15
19X	108.20	-	-	1043	12	-	980	12

Figure 1.

COVERAGE VOLUMES


ELEVATION
MAXIMUM LIMIT
30°
15°
20,000'
NORMAL GLIDE PATH
3°
20 NMI
AZIMUTH
-60°
-40°
APPROACH AZIMUTH
20 NMI
+40°
+60°
MAXIMUM LIMIT
*WHEN INSTALLED
*BACK AZIMUTH
7 NMI
-40°
+40°

15. INTERIM STANDARD MICROWAVE LANDING SYSTEM (ISMLS)

a. The ISMLS is designed to provide approach information similar to the ILS for an aircraft on final approach to a runway. The system provides both lateral and vertical guidance which is displayed on a conventional course deviation indicator or approach horizon. Operational performance and coverage areas are similar to the ILS system.

b. ISMLS operates in the C-band microwave frequency range (about 5000 MHz). ISMLS signals will not be received by unmodified VHF/UHF ILS receivers. Aircraft utilizing ISMLS must be equipped with a C-band receiving antenna in addition to other special equipment mentioned below. The C-band antenna limits reception of the signal to an angle of about 50 degrees from the inbound course. An aircraft so equipped will not receive the ISMLS signal until flying a magnetic heading within 50 degrees either side of the inbound course. Because of this, ISMLS procedures are designed to restrict the use of the ISMLS signal until the aircraft is in position for the final approach. Transition to the ISMLS, holding and procedure turns at the ISMLS facility must be predicated on other navigation aids such as NDB, VOR, etc. Once established on the approach course inbound, the system can be flown the same as an ILS. No back course is provided.

c. The ISMLS consists of the following basic components:

(1) C-Band (5000 MHz-5030 MHz) localizer.

(2) C-Band (5220 MHz-5250 MHz) glide path.

(3) VHF marker beacons (75 MHz).

(4) A VHF/UHF ILS receiver modified to recieve ISMLS signals.

(5) C-Band antenna.

(6) Converter unit.

(7) A Microwave/ILS Mode Control.

d. Identification consists of a three letter Morse Code identifier preceded by the Morse Code for "M" (- -) (e.g., M—STP). The "M" distinguishes this system from ILS which is preceded by the Morse Code for "I" (..) (e.g., I-STP).

e. Approaches published in conjunction with the ISMLS are identified as "MLS Rwy—(Interim)." The frequency displayed on the ISMLS approach chart is a VHF frequency. ISMLS frequencies are tuned by setting the receiver to the listed VHF frequencies. When the ISMLS mode is selected, receivers modified to accept ISMLS signals receive a paired C-band frequency that is processed by the receiver.

CAUTION: Pilots should not attempt to fly ISMLS procedures unless the aircraft is so equipped.

16. MAINTENANCE OF FAA NAVAIDS

During periods of routine or emergency maintenance, coded identification (or code and voice, where applicable) is removed from certain FAA NAVAIDs. Removal of identification serves as a warning to pilots that the facility is officially off the air for tune-up or repair and may be unreliable even though intermittent or constant signals are received.

NOTE- During periods of maintenance VHF ranges may radiate a T-E-S-T code (— ● ●●● —).

17. NAVAIDS WITH VOICE

a. Voice equipped en route radio navigational aids are under the operational control of either an FAA FSS or an approach control facility. Most NAVAIDs are remotely operated.

b. Unless otherwise noted on the chart, all radio navigation aids operate continuously except during interruptions for voice transmissions on the same frequencies where simultaneous transmission is not available, and during shutdowns for maintenance. Hours of operation of facilities not operating continuously are annotated on charts and in the Airport/Facility Directory.

18. RESERVED

19. USER REPORTS ON NAVAID PERFORMANCE

a. Users of the National Airspace System (NAS) can render valuable assistance in the early correction of NAVAID malfunctions by reporting their observations of undesirable NAVAID performance. Although the NAVAID is monitored by electronic detectors within the equipment or in the field of radiation near the antenna, adverse effects of electronic interference, new obstructions or changes in terrain near the NAVAID can exist without detection by the ground monitors. Some of the characteristics of malfunction or deteriorating performance which should be reported are: erratic course or bearing indications; intermittent, or full, flag alarm; garbled, missing or obviously improper coded identification; poor quality communications reception; or, in the case of frequency interference, an audible hum or tone accompanying radio communications or NAVAID identification.

b. User reports should identify the NAVAID, location of the aircraft, time of the observation and type of aircraft and describe the condition observed; the type of receivers in use will also be useful information. User reports can be made in any of the following ways:

(1) Immediate report by direct radio communication to the controlling Air Route Traffic Control Center (ARTCC), Control Tower, or FSS. This method will provide the most timely resolution of the reported condition.

(2) Report by telephone to the nearest FAA facility.

(3) Report by FAA Form 8000-7, Safety Improvement Report. This is a self addressed, postage-paid card designed with this purpose in mind. A supply of these cards may be found at FAA FSSs, General Aviation District Offices and General Aviation Fixed Base Operations.

c. In complex aircraft radio installations involving more than one receiver, there are many combinations of possible interference between units. This interference can cause either erroneous navigation indications, or complete or partial blanking out of the communications. Pilots should be familiar enough with the radio installation of the particular airplanes they fly to recognize this type of interference.

20. LORAN

LORAN-A service has been terminated in the U.S. coastal confluence region. Prerecorded telephone answering service messages pertaining to LORAN-C operations are available as follows:

RATE	CHAIN	TELEPHONE
5930	Canadian East Coast	709-454-3261*
7980	Southeast U.S.	904-569-5241
8970	Great Lakes	607-869-5395
9960	Northeast U.S.	607-869-5395

*St. Anthony, Newfoundland, Canada

Additional information can be obtained directly from the office of the Coordinator of Chain Operations (COCO) for each chain. The following telephone numbers are for each COCO office:

RATE	CHAIN	TELEPHONE	LOCATION
5930	Canadian East Coast	709-454-2392	St. Anthony, Nfld.
7980	Southeast U.S.	904-569-2223	Malone, FL
8970	Great Lakes	607-869-5393	Seneca, NY
9960	Northeast U.S.	607-869-5393	Seneca, NY
4990	Central Pacific	808-247-5591	Kaneohe, HI
5990	Canadian West Coast	707-987-2911	Middletown, CA
7960	Gulf of Alaska	907-487-5583	Kodiak, AK
9940	U.S. West Coast	707-987-2911	Middletown, CA
9970	Northwest Pacific	415-273-4393	San Francisco, CA
9990	North Pacific	907-487-5583	Kodiak, AK
7930	North Atlantic	011-44-1-409-4415	London, U.K.
7970	Norwegian Sea	011-44-1-409-4415	London, U.K.
7990	Mediterranean Sea	011-44-1-409-4415	London, U.K.

21. OMEGA AND OMEGA/VLF NAVIGATION SYSTEMS

a. OMEGA

(1) OMEGA is a network of eight transmitting stations located throughout the world to provide worldwide signal coverage. These stations transmit a phase stable 10 kW signal in the Very Low Frequency (VLF) band. Because of the low frequency, the signals are receivable to ranges of thousands of miles. The eight stations are located in Norway, Liberia, Hawaii, North Dakota (USA), La Reunion, Argentina, Australia, and Japan.

(2) Presently each station transmits on four basic navigational frequencies: 10.2 kHz, 11.05 kHz, 11.3 kHz, and 13.6 kHz, in sequenced format. This time sequenced format prevents interstation signal interference. With eight stations and a silent .2-second interval between each transmission, the entire cycle repeats every 10 seconds.

(3) In addition to the four basic navigational frequencies, each station transmits a unique navigation frequency. An OMEGA station is said to be operating in full format when the station is transmitting on the basic frequencies plus the unique frequency. Unique frequencies are presently assigned as follows:

STATION	LOCATION	FREQUENCY
Station A	Norway	12.1 kHz
Station B	Liberia	12.0 kHz
Station C	Hawaii	11.8 kHz
Station D	North Dakota	13.1 kHz
Station E	La Reunion	12.3 kHz
Station F	Argentina	12.9 kHz
Station G	Australia	13.0 kHz
Station H	Japan	12.8 kHz

b. VLF

(1) The U.S. Navy operates a communications system in the VLF band. The transmitting stations are located worldwide and transmit at powers of 500-1000 kW. Some airborne OMEGA receivers have the capability to receive and process these VLF signals for navigation in addition to OMEGA signals. The VLF stations generally used for navigation are located in Australia, Japan, England, Hawaii and in the U.S. in Maine, Washington and Maryland (Annapolis).

(2) Although the Navy does not object to the use of VLF communications signals for navigation, the system is not dedicated to navigation. Signal format, transmission,

and other parameters of the VLF system are subject to change at the Navy's discretion. The VLF communications stations are individually shut down for scheduled maintenance for a few hours each week. Regular NOTAM service regarding the VLF system or station status is not available. However, the Naval Observatory provides a taped message concerning phase differences, phase values, and shutdown information for both the VLF communications network and the OMEGA system (phone 202-653-1757).

c. **Operational Use of OMEGA and OMEGA/VLF**

(1) Experience has shown that the OMEGA navigation network is capable of providing consistent fixing information to an accuracy of plus or minus 2 NM depending upon the level of sophistication of the receiver/processing system. OMEGA signals are affected by propagation variables which may degrade fix accuracy. These variables include diurnal variation of phase velocity, polar cap absorption, and sudden ionospheric disturbances (solar activity). Although the diurnal variation can be compensated for within the receiver/processor, occasional excessive solar activity and its effect on OMEGA cannot be completely forecast or anticipated. If an unusual amount of solar activity disturbs the OMEGA signal propagation paths to any extent, the U.S. Coast Guard advises the FAA and an appropriate NOTAM is promulgated.

(2) At 16 minutes past each hour, WWV (Fort Collins, Colorado) broadcasts a message concerning the status of each OMEGA station, signal anomalies, and other information concerning OMEGA. At 47 minutes past each hour, WWVH (Hawaii) broadcasts similar information. The U.S. Coast Guard provides a taped OMEGA status report (202-245-0298). NOTAMS concerning OMEGA are available through any FSS. It is recommended that OMEGA NOTAMs be requested by OMEGA station name.

(3) The FAA has recognized OMEGA and OMEGA/VLF systems as an additional, but not the sole, means of en route IFR navigation in the conterminous United States and Alaska when approved in accordance with FAA guidance information. Use of OMEGA or OMEGA/VLF requires that all navigation equipment otherwise required by the Federal Aviation Regulations be installed and operating. When flying RNAV routes, VOR and DME are required to be installed.

(4) The FAA does not recognize the use of the Naval VLF communications system as a sole means of navigation. VLF communications signals may be used to supplement OMEGA navigation if the equipment is capable of reverting to OMEGA only for navigation.

22. VHF DIRECTION FINDER

a. The VHF Direction Finder (VHF/DF) is one of the common system equipments that helps the pilot without his being aware of its operation. The VHF/DF is a ground based radio receiver used by the operator of the ground station where it is located. FAA facilities having capability to provide VHF/DF service are identified in the Airport/Facility Directory.

b. The equipment consists of a directional antenna system and a VHF radio receiver. At a radar equipped tower or center, the cathode ray tube indications may be superimposed on the radarscope.

c. The VHF/DF display indicates the magnetic direction of the aircraft from the station each time the aircraft transmits. Where DF equipment is tied into radar, a strobe of light is flashed from the center of the radarscope in the direction of the transmitting aircraft.

d. DF equipment is of particular value in locating lost aircraft and in helping to identify aircraft on radar. (See PARA. 452 - DIRECTION FINDING INSTRUMENT APPROACH PROCEDURE.)

23. INERTIAL NAVIGATION SYSTEM (INS)

A totally self-contained navigation system, comprised of gyros, accelerometers, and a navigation computer, which provides aircraft position and navigation information in response to signals resulting from inertial effects on system components, and does not require information from external references. INS is aligned with accurate position information prior to departure, and thereafter calculates its position as it progresses to the destination. By programming a series of waypoints, the system will navigate along a predetermined track. New waypoints can be inserted at any time if a revised routing is desired. INS accuracy is very high initially following alignment, and decays with time at the rate of about 1-2 nautical miles per hour. Position update alignment can be accomplished inflight using ground based references, and many INS systems now have sophisticated automatic update using dual DME and or VOR inputs. INS may be approved as the sole means of navigation or may be used in combination with other systems.

24. DOPPLER RADAR

A semiautomatic self-contained dead reckoning navigation system (radar sensor plus computer) which is not continuously dependent on information derived from ground based or external aids. The system employs radar signals to detect and measure ground speed and drift angle, using the aircraft compass system as its directional reference. Doppler is less accurate than INS or OMEGA however, and the use of an external reference is required for periodic updates if acceptable position accuracy is to be achieved on long range flights.

25. FLIGHT MANAGEMENT SYSTEM (FMS)

A computer system that uses a large data base to allow routes to be preprogrammed and fed into the system by means of a data loader. The system is constantly updated with respect to position accuracy by reference to conventional navigation aids. The sophisticated program and its associated data base insures that the most appropriate aids are automatically selected during the information update cycle.

26. GLOBAL POSITIONING SYSTEM (GPS)

A space-base radio positioning, navigation, and time-transfer system being developed by Department of Defense. When fully deployed, the system is intended to provide highly accurate position and velocity information, and precise time, on a continuous global basis, to an unlimited number of properly equipped users. The system will be unaffected by weather, and will provide a worldwide common grid reference system. The GPS concept is predicated upon accurate and continuous knowledge of the spatial position of each satellite in the system with respect to time and distance from a transmitting satellite to the user. The GPS receiver automatically selects appropriate signals from the satellites in view and translates these into a three-dimensional position, velocity, and time. Predicatable system accuracy for civil users is projected to be 100 meters horizontally. Performance standards and certification criteria have not yet been established.

27—29. RESERVED

NOTES

Section 2. RADAR SERVICES AND PROCEDURES

30. RADAR

a. Capabilities

(1) Radar is a method whereby radio waves are transmitted into the air and are then received when they have been reflected by an object in the path of the beam. *Range* is determined by measuring the time it takes (at the speed of light) for the radio wave to go out to the object and then return to the receiving antenna. The *direction* of a detected object from a radar site is determined by the position of the rotating antenna when the reflected portion of the radio wave is received.

(2) More reliable maintenance and improved equipment have reduced radar system failures to a negligible factor. Most facilities actually have some components duplicated-one operating and another which immediately takes over when a malfunction occurs to the primary component.

b. Limitations

(1) It is very important for the aviation community to recognize the fact that there are limitations to radar service and that ATC controllers may not always be able to issue traffic advisories concerning aircraft which are not under ATC control and cannot be seen on radar.

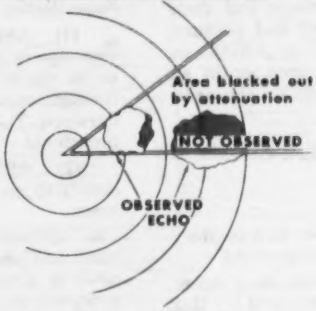
(a) The characteristics of radio waves are such that they normally travel in a continuous straight line unless they are:

1. "Bent" by abnormal atmospheric phenomena such as temperature inversions;

2. Reflected or attenuated by dense objects such as heavy clouds, precipitation, ground obstacles, mountains, etc.; or

3. Screened by high terrain features.

Precipitation Attenuation



The nearby target absorbs and scatters so much of the out- going and returning energy that the radar does not detect the distant target.

(b) The bending of radar pulses, often called anomalous propagation or ducting, may cause many extraneous blips to appear on the radar operator's display if the beam has been bent toward the ground or may decrease the detection range if the wave is bent upward. It is difficult to solve the effects of anomalous propogation, but using beacon radar and electronically eliminating stationary and slow moving targets by a method called moving target indicator (MTI) usually negate the problem.

(c) Radar energy that strikes dense objects will be reflected and displayed on the operator's scope thereby blocking out aircraft at the same range and greatly weakening or completely eliminating the display of targets at a greater range. Again, radar beacon and MTI are very effectively used to combat ground clutter and weather phenomena, and a method of circularly polarizing the radar beam will eliminate some weather returns. A negative characteristic of MTI is that an aircraft flying a speed that coincides with the canceling signal of the MTI (tangential or "blind" speed) may not be displayed to the radar controller.

(d) Relatively low altitude aircraft will not be seen if they are screened by mountains or are below the radar beam due to earth curvature. The only solution to screening is the installation of strategically placed multiple radars which has been done in some areas.

(e) There are several other factors which affect radar control. The amount of reflective surface of an aircraft will determine the size of the radar return. Therefore, a small light airplane or a sleek jet fighter will be more difficult to see on radar than a large commercial jet or

military bomber. Here again, the use of radar beacon is invaluable if the aircraft is equipped with an airborne transponder. All ARTCC radars in the conterminous U.S. and many airport surveillance radars have the capability to interrogate MODE C and display altitude information to the controller from appropriately equipped aircraft. However, there are a number of airport surveillance radars that are still two dimensional (range and azimuth) only and altitude information must be obtained from the pilot.

(f) At some locations within the ATC en route environment, secondary-radar-only (no primary radar) gap filler radar systems are used to give lower altitude radar coverage between two larger radar systems, each of which provides both primary and secondary radar coverage. In those geographical areas served by secondary-radar only, aircraft without transponders cannot be provided with radar service. Additionally, transponder equipped aircraft cannot be provided with radar advisories concerning primary targets and weather. (See RADAR/RADIO DETECTION AND RANGING in the Pilot/Controller Glossary.)

(g) The controllers' ability to advise a pilot flying on instruments or in visual conditions of his proximity to another aircraft will be limited if the unknown aircraft is not observed on radar, if no flight plan information is available, or if the volume of traffic and workload prevent his issuing traffic information. The controller's first priority is given to establishing vertical, lateral, or longitudinal separation between aircraft flying IFR under the control of ATC.

c. FAA radar units operate continuously at the locations shown in the Airport/Facility Directory, and their services are available to all pilots, both civil and military. Contact the associated FAA control tower or ARTCC on any frequency guarded for initial instructions, or in an emergency, any FAA facility for information on the nearest radar service.

31. AIR TRAFFIC CONTROL RADAR BEACON SYSTEM (ATCRBS)

a. The ATCRBS, sometimes referred to as secondary surveillance radar, consists of three main components:

(1) **Interrogator.** Primary radar relies on a signal being transmitted from the radar antenna site and for this signal to be reflected or "bounced back" from an object (such as an aircraft). This reflected signal is then displayed as a "target" on the controller's radarscope. In the ATCRBS, the *Interrogator*, a ground based radar beacon transmitter-receiver, scans in synchronism with the primary radar and transmits discrete radio signals which repetitiously requests all transponders, on the mode being used, to reply. The replies received are then mixed with the primary returns and both are displayed on the same radarscope.

(2) **Transponder.** This airborne radar beacon transmitter-receiver automatically receives the signals from the interrogator and selectively replies with a specific pulse group (code) only to those interrogations being received on the mode to which it is set. These replies are independent of, and much stronger than a primary radar return.

(3) **Radarscope.** The radarscope used by the controller displays returns from both the primary radar system and the ATCRBS. These returns, called targets, are what the controller refers to in the control and separation of traffic.

b. The job of identifying and maintaining identification of primary radar targets is a long and tedious task for the controller. Some of the advantages of ATCRBS over primary radar are:

(1) **Reinforcement of radar targets.**

(2) **Rapid target identification.**

(3) **Unique display of selected codes.**

c. A part of the ATCRBS ground equipment is the decoder. This equipment enables the controller to assign discrete transponder codes to each aircraft under his control. Normally only one code will be assigned for the entire flight. Assignments are made by the ARTCC computer on the basis of the National Beacon Code Allocation Plan. The equipment is also designed to receive MODE C altitude information from the aircraft.

NOTE.— Refer to figures with explanatory legends for an illustration of the target symbology depicted on radar scopes in the NAS Stage A (en route), the ARTS III (terminal) systems, and other nonautomated (broadband) radar systems.

d. It should be emphasized that aircraft transponders greatly improve the effectiveness of radar systems. (See PARA—170 - TRANSPONDER OPERATION.)

32. SURVEILLANCE RADAR

a. Surveillance radars are divided into two general categories: Airport Surveillance Radar (ASR) and Air Route Surveillance Radar (ARSR).

(1) ASR is designed to provide relatively short-range coverage in the general vicinity of an airport and to serve as an expeditious means of handling terminal area traffic through observation of precise aircraft locations on a radarscope. The ASR can also be used as an instrument approach aid.

(2) ARSR is a long-range radar system designed primarily to provide a display of aircraft locations over large areas.

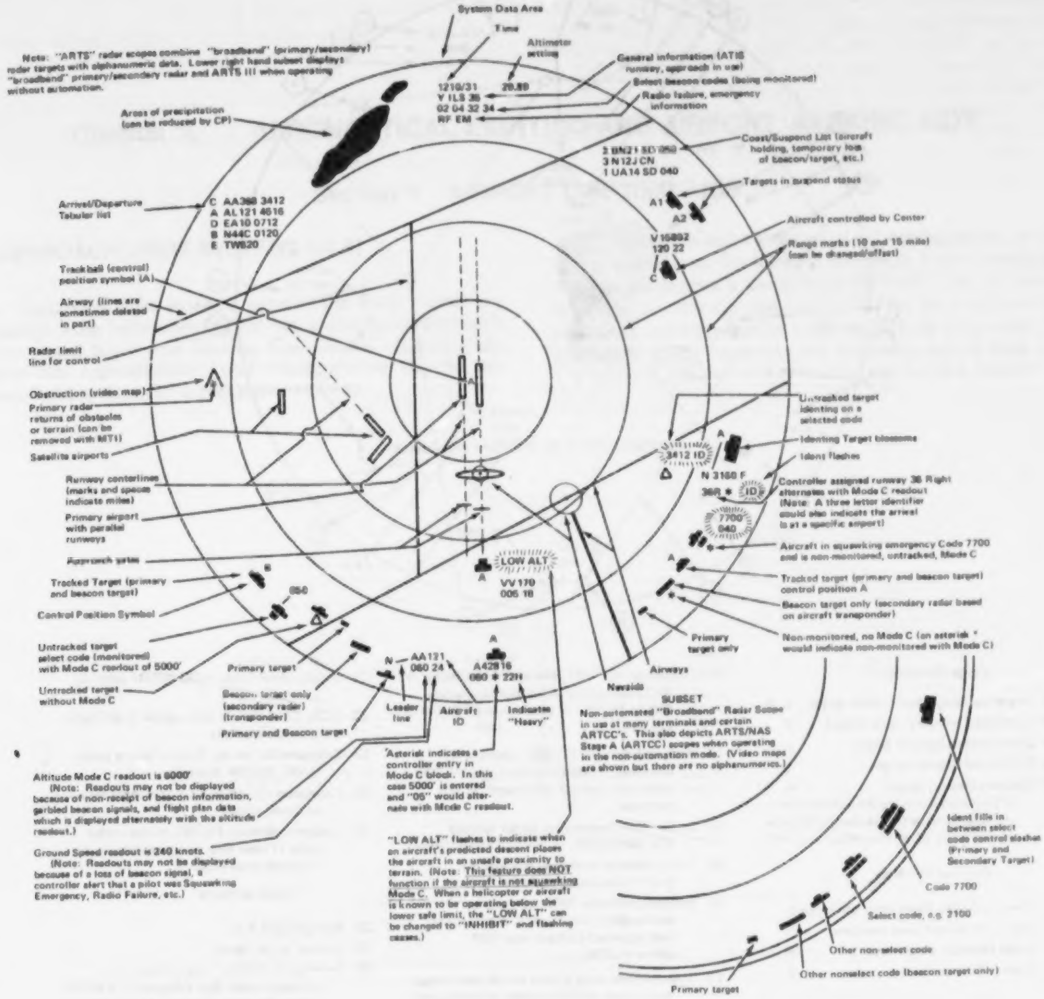
b. Surveillance radars scan through 360 degrees of azimuth and present target information on a radar display located in a tower or center. This information is used independently or in conjunction with other navigational aids in the control of air traffic.

33. PRECISION APPROACH RADAR (PAR)

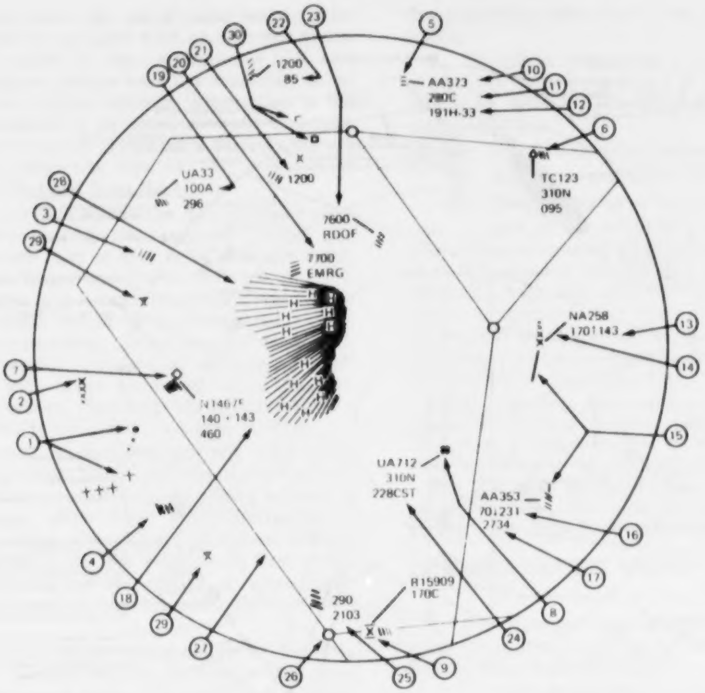
a. PAR is designed to be used as a *landing aid*, rather than an aid for sequencing and spacing aircraft. PAR equipment may be used as a primary landing aid, or it may be used to monitor other types of approaches. It is designed to display *range, azimuth* and *elevation* information.

b. Two antennas are used in the PAR array, one scanning a vertical plane, and the other scanning horizontally. Since the range is limited to 10 miles, azimuth to 20 degrees, and elevation to 7 degrees, only the final approach area is covered. Each scope is divided into two parts. The upper half presents altitude and distance information, and the lower half presents azimuth and distance.

34—39. RESERVED


Note: "ARTS" radar scopes combine "broadband" (primary/secondary) radar targets with alphanumeric data. Lower right hand subset displays "broadband" primary/secondary radar and ARTS III when operating without automation.
System Data Area
Time
Altimeter setting
1210/31
29.80
Y ILS 36
02 04 32 34
RF EM
General information (ATIS runway, approach in use)
Select beacon codes (being monitored)
Radio failure, emergency information
Areas of precipitation (can be reduced by CP)
Coast/Suspend List (aircraft holding, temporary loss of beacon/target, etc.)
2 BN21 SD 050
3 N12J CN
1 UA14 SD 040
Targets in suspend status
A1
A2
Arrival/Departure Tabular list
C AA368 3412
A AL121 4616
D EA10 0712
B N44C 0120
E TW820
Aircraft controlled by Center
V 15892
120 22
C
Range marks (10 and 15 mile) (can be changed/offset)
Trackball (control) position symbol (A)
Airway (lines are sometimes deleted in part)
Radar limit line for control
Obstruction (video map)
Primary radar returns of obstacles or terrain (can be removed with MTI)
Satellite airports
Runway centerlines (marks and spaces indicate miles)
Primary airport with parallel runways
Approach gates
Untracked target identing on a selected code
Identing Target blossoms
Ident flashes
3412 ID
A
N 3160 F
36R ✱ ID
Controller assigned runway 36 Right alternates with Mode C readout (Note: A three letter identifier could also indicate the arrival is at a specific airport)
7700
040
Aircraft in squawking emergency Code 7700 and is non-monitored, untracked, Mode C
Tracked target (primary and beacon target) control position A
Beacon target only (secondary radar based on aircraft transponder)
Non-monitored, no Mode C (an asterisk * would indicate non-monitored with Mode C)
LOW ALT
A
VV 170
005 18
Tracked Target (primary and beacon target)
Control Position Symbol
050
Untracked target select code (monitored) with Mode C readout of 5000'
Untracked target without Mode C
Primary target
Beacon target only (secondary radar) (transponder)
Primary and Beacon target
Primary target only
N
AA121
080 24
A
A42816
080 ✱ 22H
Leader line
Aircraft ID
Indicates "Heavy"
Navaids
Airways
SUBSET
Non-automated "Broadband" Radar Scope in use at many terminals and certain ARTCC's. This also depicts ARTS/NAS Stage A (ARTCC) scopes when operating in the non-automation mode. (Video maps are shown but there are no alphanumerics.)
Altitude Mode C readout is 6000' (Note: Readouts may not be displayed because of non-receipt of beacon information, garbled beacon signals, and flight plan data which is displayed alternately with the altitude readout.)
Ground Speed readout is 240 knots. (Note: Readouts may not be displayed because of a loss of beacon signal, a controller alert that a pilot was Squawking Emergency, Radio Failure, etc.)
Asterisk indicates a controller entry in Mode C block. In this case 5000' is entered and "05" would alternate with Mode C readout.
"LOW ALT" flashes to indicate when an aircraft's predicted descent places the aircraft in an unsafe proximity to terrain. (Note: This feature does NOT function if the aircraft is not squawking Mode C. When a helicopter or aircraft is known to be operating below the lower safe limit, the "LOW ALT" can be changed to "INHIBIT" and flashing ceases.)
Ident fills in between select code control slashes (Primary and Secondary Target)
Code 7700
Select code, e.g. 2100
Other non-select code
Other nonselect code (beacon target only)
Primary target

ARTS III Radar Scope with Alphanumeric Data. Note: A number of radar terminals do not have ARTS equipment. Those facilities and certain ARTCC's outside the contiguous US would have radar displays similar to the lower right hand subset. ARTS facilities and NAS Stage A ARTCC's, when operating in the non-automation mode would also have similar displays and certain services based on automation may not be available.



Target Symbols

1 Uncorrelated primary radar target + ●
2 *Correlated primary radar target X
3 Uncorrelated beacon target /
4 Correlated beacon target \
5 Identing beacon target ≡
(*Correlated means the association of radar data with the computer projected track of an identified aircraft)

Position Symbols

6 Free track (No flight plan tracking) △
7 Flat track (flight plan tracking) ◊
8 Coast (Beacon target lost) #
9 Present Position Hold ⧖

Data Block Information

10 *Aircraft Identification
11 *Assigned Altitude FL280, mode C altitude same or within ±200′ of asgnd altitude
12 *Computer ID #191, Handoff is to Sector 33 (0-33 would mean handoff accepted) (*Nr's 10, 11, 12 constitute a "full data block")
13 Assigned altitude 17,000′, aircraft is climbing, mode C readout was 14,300 when last beacon interrogation was received
14 Leader line connecting target symbol and data block
15 Track velocity and direction vector line (Projected ahead of target)
16 Assigned altitude 7000, aircraft is descending, last mode C readout (or last reported altitude was 100′ above FL230
17 Transponder code shows in full data block only when different than assigned code
18 Aircraft is 300′ above assigned altitude
19 Reported altitude (No mode C readout) same as assigned. An "N" would indicate no reported altitude)
20 Transponder set on emergency code 7700 (EMRG flashes to attract attention)
21 Transponder code 1200 (VFR) with no mode C
22 Code 1200 (VFR) with mode C and last altitude readout
23 Transponder set on Radio Failure code 7600, (RDOF flashes)
24 Computer ID #228, CST indicates target is in Coast status
25 Assigned altitude FL290, transponder code (These two items constitute a "limited data block")

Other symbols

26 Navigational Aid
27 Airway or jet route
28 Outline of weather returns based on primary radar (See Chapter 4, ARTCC Radar Weather Display. H's represent areas of high density precipitation which might be thunderstorms. Radial lines indicate lower density precipitation)
29 Obstruction
30 Airports Major: ☐ , Small: ⌜

NAS Stage A Controllers View Plan Display. This figure illustrates the controller's radar scope (PVD) when operating in the full automation (RDP) mode, which is normally 20 hours per day. (Note: When not in automation mode, the display is similar to the broadband mode shown in the ARTS III Radar Scope figure. Certain ARTCC's outside the contiguous U.S. also operate in "broadband" mode.)

Chapter 2. AERONAUTICAL LIGHTING AND AIRPORT MARKING AIDS

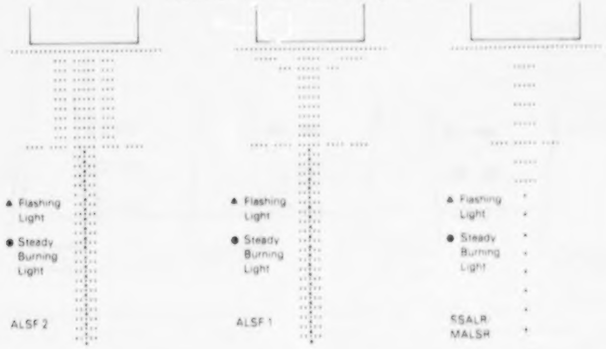
Section 1. AIRPORT LIGHTING AIDS

40. APPROACH LIGHT SYSTEMS (ALS)

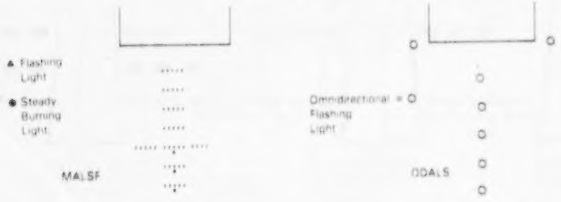
a. Approach light systems provide the basic means for transition from instrument flight using electronic approach aids to visual flight and landing. Operational requirements dictate the sophistication and configuration of the approach light system for a particular runway.

b. Approach light systems are a configuration of signal lights starting at the landing threshold and extending into the approach area a distance of 2400-3000 feet for precision instrument runways and 1400-1500 feet for nonprecision instrument runways. Some systems include sequenced flashing lights which appear to the pilot as a ball of light traveling towards the runway at high speed twice a second.

Precision Instrument Configurations



Nonprecision Instrument Configurations



41. VISUAL APPROACH SLOPE INDICATOR (VASI)

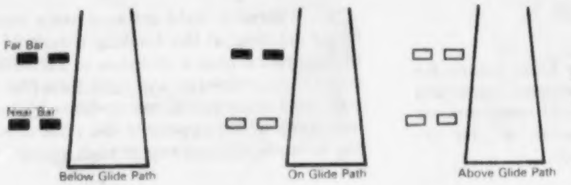
a. The VASI is a system of lights so arranged to provide visual descent guidance information during the approach to a runway. These lights are visible from 3-5 miles during the day and up to 20 miles or more at night. The visual glide path of the VASI provides safe obstruction clearance within plus or minus 10 degrees of the extended runway centerline and to 4 NM from the runway threshold. Descent, using the VASI, should not be initiated until the aircraft is visually aligned with the runway. Lateral course guidance is provided by the runway or runway lights.

b. VASI installations may consist of either 2, 4, 6, 12, or 16 lights units arranged in bars referred to as near, middle, and far bars. Most VASI installations consist of 2 bars, near and far, and may consist of 2, 4, or 12 light units. Some airports have VASIs consisting of three bars, near, middle, and far, which provide an additional visual glide path for use by high cockpit aircraft. This installation may consist of either 6 or 16 light units. VASI installations consisting of 2, 4, or 6 light units are located on one side of the runway, usually the left. Where the installation consists of 12 or 16 light units, the light units are located on both sides of the runway.

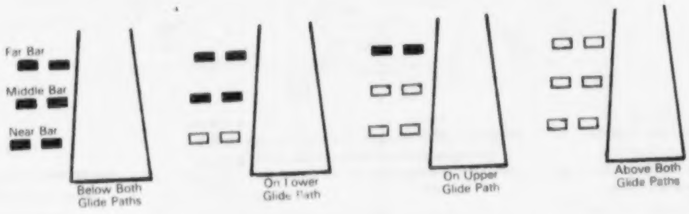
c. Two-bar VASI installations provide one visual glide path which is normally set at 3 degrees. Three-bar VASI installations provide two visual glide paths. The lower glide path is provided by the near and middle bars and is normally set at 3 degrees while the upper glide path, provided by the middle and far bars, is normally 1/4 degree higher. This higher glide path is intended for use only by high cockpit aircraft to provide a sufficient threshold crossing height. Although normal glide path angles are three degrees, angles at some locations may be as high as 4.5 degrees to give proper obstacle clearance. Pilots of high performance aircraft are cautioned that use of VASI angles in excess of 3.5 degrees may cause an increase in runway length required for landing and rollout.

d. The basic principle of the VASI is that of color differentiation between red and white. Each light unit projects a beam of light having a white segment in the upper part of the beam and red segment in the lower part of the beam. The light units are arranged so that the pilot using the VASIs during an approach will see the combination of lights shown below.

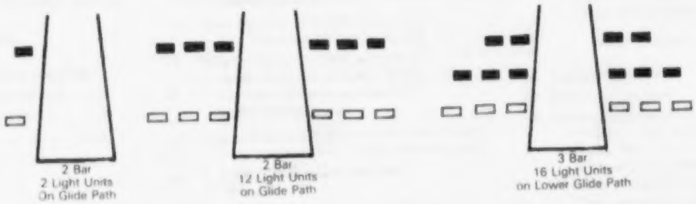
e. 2-bar VASI (4 light units shown)


Far Bar
Near Bar
Below Glide Path
On Glide Path
Above Glide Path
▬ = Red
▭ = White

f. 3-bar VASI (6 light units shown)


Far Bar
Middle Bar
Near Bar
Below Both Glide Paths
On Lower Glide Path
On Upper Glide Path
Above Both Glide Paths

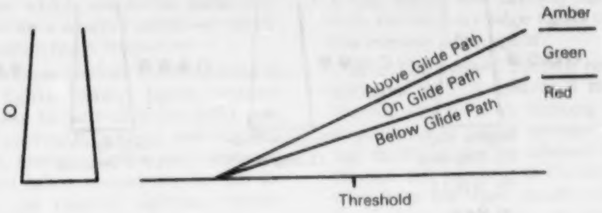
g. Other VASI configurations


2 Bar
2 Light Units
On Glide Path
2 Bar
12 Light Units
on Glide Path
3 Bar
16 Light Units
on Lower Glide Path

42. OTHER VISUAL APPROACH SLOPE SYSTEMS

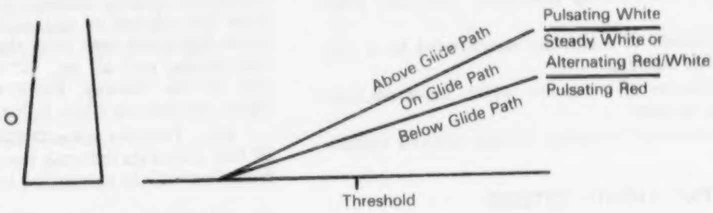
a. Several types of nonstandard visual approach slope indicators have been installed at general aviation and air carrier airports.

b. Tri-color visual approach slope indicators normally consist of a single light unit projecting a three-color visual approach path into the final approach area of the runway upon which the indicator is installed. The below glide path indication is red, the above glide path indication is amber, and the on glide path indication is green. These types of indicators have a useful range of approximately one-half to one mile during the day and up to five miles at night depending upon the visibility conditions.

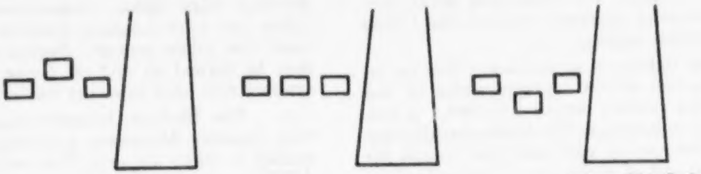


Caution: This yellow-green-red configuration produces a yellow-green transition light beam between the yellow and green primary light segments and an anomalous yellow transition light beam between the green and red primary light segments. This anomalous yellow signal could cause confusion with the primary yellow too-high signal.

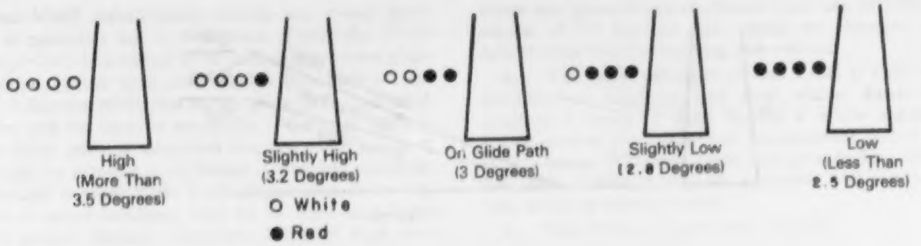
c. Pulsating visual approach slope indicators normally consist of a single light unit projecting a two-color visual approach path into the final approach area of the runway upon which the indicator is installed. The below glide path indication is normally pulsating red and the above glide path indication is normally pulsating white. The on glide path indication for one type of system is a steady white light while for another type system the on glide path indication consists of an alternating red and white light. The useful range of these systems is about four miles during the day and up to ten miles at night.



d. Alignment of elements systems are installed on some small general aviation airports and are a low-cost system consisting of painted plywood panels, normally black and white or fluorescent orange. Some of these systems are lighted for night use. The useful range of these systems is approximately three-quarter miles. To use the system the pilot positions his aircraft so the elements are in alignment. The glide path indications are as follows.


Above Glide Path
On Glide Path
Below Glide Path

e. The precision approach path indicator (PAPI) uses light units similar to the VASI but are installed in a single row of either two or four light units. These systems have an effective visual range of about 5 miles during the day and up to 20 miles at night. The row of light units is normally installed on the left side of the runway and the glide path indications are as follows.



43. RUNWAY END IDENTIFIER LIGHTS (REIL)

REILs are installed at many airfields to provide rapid and positive identification of the approach end of a particular runway. The system consists of a pair of synchronized flashing lights, one of which is located laterally on each side of the runway threshold. REILs may be either omnidirectional or unidirectional facing the approach area. REILs may be located longitudinally 200 feet either upwind or downwind from the runway threshold. They are effective for:

(1) Identification of a runway surrounded by a preponderance of other lighting.

(2) Identification of a runway which lacks contrast with surrounding terrain.

(3) Identification of a runway during reduced visibility.

44. RUNWAY EDGE LIGHT SYSTEMS

a. Runway edge lights are used to outline the edges of runways during periods of darkness and restricted visibility conditions. These light systems are classified according to the intensity or brightness they are capable of producing: they are the High Intensity Runway Lights (HIRL), Medium Intensity Runway Lights (MIRL), and the Low Intensity Runway Lights (LIRL). The HIRL and MIRL systems have variable intensity controls, whereas the LIRLs normally have one intensity setting.

b. The runway edge lights are white except that on instrument runways aviation yellow replaces white on the last 2,000 feet or half the runway length, whichever is less, to form a caution zone for landings. The lights marking the longitudinal limits of the runway emit red light toward the runway to indicate the end of runway to a departing aircraft and emit green outward from the runway end to indicate the threshold to landing aircraft.

45. IN-RUNWAY LIGHTING

a. Touchdown zone lighting and runway centerline lighting are installed on some precision approach runways to facilitate landing under adverse visibility conditions. Taxiway turnoff lights may be added to expedite movement of aircraft from the runway.

(1) **Touchdown Zone Lighting (TDZL) —** two rows of transverse light bars disposed symmetrically about the runway centerline in the runway touchdown zone. The system starts 100 feet from the landing threshold and extends to 3000 feet from the threshold or the midpoint of the runway, whichever is the lesser.

(2) **Runway Centerline Lighting (RCLS) —** flush centerline lights spaced at 50-foot intervals beginning 75 feet from the landing threshold and extending to within 75 feet of opposite end of the runway.

(3) **Runway Remaining Lighting —** is applied to centerline lighting systems in the final 3,000 feet as viewed from the takeoff or approach position. Alternate red and white lights are seen from the 3,000 foot points to the 1,000 foot points, and all red lights are seen for the last 1,000 feet of the runway. From the opposite direction, these lights are seen as white lights.

(4) **Taxiway turnoff lights —** flush lights spaced at 50 foot intervals defining the curved path of aircraft travel from the runway centerline to a point on the taxiway.

46. CONTROL OF LIGHTING SYSTEMS

a. Operation of approach light systems and runway lighting is controlled by the control tower. At some locations the FSS may control the lights where there is no control tower in operation.

b. Pilots may request that lights be turned on or off. Runway edge lights, in-pavement lights and approach lights also have intensity controls which may be varied to meet the pilots request. Sequenced flashing lights (SFL) may be turned on and off. Some sequenced flashing light systems also have intensity control.

c. The Medium Intensity Approach Lighting System with Runway Alignment Indicators (MALSR) has been installed at many airports. The control of MALSR is now by ATCTs and/or radio control from approaching aircraft. (See PARA—47 - PILOT CONTROL OF AIRPORT LIGHTING.)

47. PILOT CONTROL OF AIRPORT LIGHTING

a. Radio control of lighting is available at selected airports to provide airborne or ground control of lights by keying the aircraft's microphone. Control of lighting systems is available either full-time at those locations without specified hours for lighting or with no control tower or FSS, or part-time (during unmanned periods) at those locations with a part-time tower or FSS or specified hours for

lighting. All lighting systems which are to be radio controlled at an airport, whether on a single runway or multiple runways, operate on the same radio frequency.

b. With FAA approved systems, various combinations of medium intensity approach lights, runway lights, taxiway lights, VASI and/or REIL may be activated by radio control. On runways with both approach lighting and runway lighting (runway edge lights, taxiway lights, etc.) systems, the approach lighting system takes precedence for air-to-ground radio control over the runway lighting system which is set at a predetermined intensity step, based on expected visibility conditions. Runways without approach lighting may provide radio controlled intensity adjustments of runway edge lights. Other lighting systems, including VASI, REIL, and taxiway lights may be either controlled with the runway edge lights or controlled independently of the runway edge lights.

c. The control system consists of a 3-step control responsive to 7, 5, and/or 3 microphone clicks. This 3-step control will turn on lighting facilities capable of either 3-step, 2-step or 1-step operation. The 3-step and 2-step lighting facilities can be altered in intensity, while the 1-step cannot. All lighting is illuminated for a period of 15 minutes from the most recent time of activation and may not be extinguished prior to end of the 15 minute period (except for 1-step and 2-step REILs which may be turned off when desired by keying the mike 5 or 3 times respectively).

TABLE 1. RUNWAYS WITH APPROACH LIGHTS

Lighting System	No. of Int. Steps	Status During Nonuse Period	Intensity Step Selected Per No. of Mike Clicks		
			3 Clicks	5 Clicks	7 Clicks
Approach Lights (Med. Int.)	2	Off	Low	Low	High
Approach Lights (Med. Int.)	3	Off	Low	Med	High
MIRL	3	Off or Low	⌗	⌗	⌗
HIRL	5	Off or Low	⌗	⌗	⌗
VASI	2	Off	◊	◊	◊

NOTES:

⌗ Predetermined intensity step.
◊ Low intensity for night use. High intensity for day use as determined by photocell control.

TABLE 2. RUNWAYS WITHOUT APPROACH LIGHTS

Lighting System	No. of Int. Steps	Status During Nonuse Period	Intensity Step Selected Per No. of Mike Clicks		
			3 Clicks	5 Clicks	7 Clicks
MIRL	3	Off or Low	Low	Med.	High
HIRL	5	Off or Low	Step 1 or 2	Step 3	Step 5
LIRL	1	Off	On	On	On
VASI ☆	2	Off	◊	◊	◊
REIL ☆	1	Off	Off	On / Off	On
REIL ☆	3	Off	Low	Med.	High

NOTES:

◊ Low intensity for night use. High intensity for day use as determined by photocell control.
☆ The control of VASI and/or REIL may be independent of other lighting systems.

d. Suggested use is to always initially key the mike 7 times; this assures that all controlled lights are turned on to the maximum available intensity. If desired, adjustment can then be made, where the capability is provided, to a lower intensity (or the REIL turned off) by keying 5 and/or 3 times. Even though the runway lights are on when arriving over an airport of intended landing, always key mike as directed in order to assure a full 15 minutes lighting duration. Approved lighting systems may be activated by keying the mike (within 5 seconds) as indicated below:

RADIO CONTROL SYSTEM

Key Mike	*Function*
7 times within 5 seconds	Highest intensity available
5 times within 5 seconds	Medium or lower intensity (Lower REIL or REIL-off)
3 times within 5 seconds	Lowest intensity available (Lower REIL or REIL-off)

e. For all public use airports with FAA standard systems the Airport/Facility Directory contains the types of lighting, runway and the frequency that is used to activate the system. Airports with IAPs include data on the approach chart identifying the light system, the runway on which they are installed, and the frequency that is used to activate the system.

EXAMPLE:

ACTIVATE MIRL Rwy 18/36-122.8.

EXAMPLE:

ACTIVATE MALSR, VASI and REIL Rwy 7, HIRL Rwy 7-25, and REIL Rwy 25-122.8.

f. Where the airport is not served by an IAP, it may have either the standard FAA approved control system or an independent type system of different specification installed by the airport sponsor. The Airport/Facility Directory contains descriptions of pilot controlled lighting systems for each airport having other than FAA approved systems, and explains the type lights, method of control, and operating frequency in clear text.

48. AIRPORT (ROTATING) BEACONS

a. The airport beacon has a vertical light distribution such as to make it most effective at angles of one up to 10 degrees above the horizontal from its site; however, it can be seen well above and below this peak spread. The beacon may be an omnidirectional capacitor-discharge device, or it

may rotate at a constant speed which produces the visual effect of flashes at regular intervals. Flashes may be one or two colors alternately. The total number of flashes are:

(1) 12 to 30 per minute for beacons marking airports, landmarks, and points on Federal airways.

(2) 30 to 60 per minute for beacons marking heliports.

b. The colors and color combinations of beacons are:

(1) White and Green — Lighted land airport

(2) *Green alone — Lighted land airport

(3) White and Yellow — Lighted water airport

(4) *Yellow alone — Lighted water airport

(5) White and Red — Landmark or navigational point (rare installation)

(6) White alone — Unlighted land airport (rare installation)

(7) Green, Yellow, and White — Lighted heliport

NOTE.— *Green alone or yellow alone is used only in connection with a white-and-green or white-and-yellow beacon display, respectively.

c. Military airport beacons flash alternately white and green, but are differentiated from civil beacons by dual-peaked (two quick) white flashes between the green flashes.

d. In control zones, operation of the airport beacon during the hours of daylight often indicates that the ground visibility is less than 3 miles and/or the ceiling is less than 1,000 feet. ATC clearance in accordance with FAR—91 would be required for landing, takeoff and flight in the traffic pattern. Pilots should not rely solely on the operation of the airport beacon to indicate weather conditions, IFR versus VFR. At locations with control towers and if controls are provided, ATC personnel turn the beacon on. However, at many airports throughout the country, the airport beacon is turned on by a photoelectric cell or time clocks and ATC personnel have no control as to when it shall be turned on. Also, there is no regulatory requirement for daylight operation and pilots are reminded that it remains their responsibility for complying with proper preflight planning in accordance with FAR—91.5.

49. RUNWAY DISTANCE REMAINING MARKERS

Runway distance remaining markers consist of signs located along the sides of a runway to indicate the remaining runway distance in increments of 1,000 feet. The signs may be located on both sides, or only one side, of the runway. The signs have white numerals on a black background and are lighted for nighttime and low visibility operations. Since runways rarely exist in exact multiples of 1,000 feet, the excess distance is added to the runway ends. Therefore, the last sign on each runway end may be located more, but never less, then 1,000 feet from the runway end. For this reason, the runway distance remaining markers often will not exactly coincide with distance remaining information of other runway lighting systems.

NOTES

Section 2. AIR NAVIGATION AND OBSTRUCTION LIGHTING

50. AERONAUTICAL LIGHT BEACONS

a. An aeronautical light beacon is a visual NAVAID displaying flashes of white and/or colored light to indicate the location of an airport, a heliport, a landmark, a certain point of a Federal airway in mountainous terrain, or an obstruction. The light used may be a rotating beacon or one or more flashing lights. The flashing lights may be supplemented by steady burning lights of lesser intensity.

b. The color or color combination displayed by a particular beacon and/or its auxiliary lights tell whether the beacon is indicating a landing place, landmark, point of the Federal airways, or an obstruction. Coded flashes of the auxiliary lights, if employed, further identify the beacon site.

51. CODE BEACONS AND COURSE LIGHTS

a. CODE BEACONS

(1) The code beacon, which can be seen from all directions, is used to identify airports and landmarks and to mark obstructions. The number of code beacon flashes are:

(a) **Green coded flashes** not exceeding 40 flashes or character elements per minute, or constant flashes 12 to 15 per minute, for identifying land airports.

(b) **Yellow coded flashes** not exceeding 40 flashes or character elements per minute, or constant flashes 12 to 15 per minute, for identifying water airports.

(c) **Red flashes,** constant rate, 12 to 40 flashes per minute for marking hazards.

b. COURSE LIGHTS

(1) The course light, which can be seen clearly from only one direction, is used only with rotating beacons of the Federal Airway System: two course lights, back to back, direct coded flashing beams of light in either direction along the course of airway.

NOTE.— Airway beacons are remnants of the "lighted" airways which antedated the present electronically equipped Federal Airways System. Only a few of these beacons exist today to mark airway segments in remote mountain areas. Flashes in Morse Code identify the beacon site.

52. OBSTRUCTION LIGHTS

a. Obstructions are marked/lighted to warn airmen of its presence during daytime and nighttime conditions. They may be marked/lighted in any of the following combinations:

(1) **Aviation Red Obstruction Lights.** Flashing aviation red beacons and steady burning aviation red lights during nighttime operation. Aviation orange and white paint is used for daytime marking.

(2) **High Intensity White Obstruction Lights.** Flashing high intensity white lights during daytime with reduced intensity for twilight and nighttime operation. When this type system is used, the marking of structures with red obstruction lights and aviation orange and white paint may be omitted.

(3) **Dual Lighting.** A combination of flashing aviation red beacons and steady burning aviation red lights for nighttime operation and flashing high intensity white lights for daytime operation. Aviation orange and white paint may be omitted.

b. High intensity flashing white lights are being used to identify some supporting structures of overhead transmission lines located across rivers, chasms, gorges, etc. These lights flash in a middle, top, lower light sequence at approximately 60 flashes per minute. The top light is normally installed near the top of the supporting structure, while the lower light indicates the approximate lower portion of the wire span. The lights are beamed towards the companion structure and identify the area of the wire span.

c. High intensity, flashing white lights are also employed to identify tall structures, such as chimneys and towers, as obstructions to air navigation. The lights provide a 360 degree coverage about the structure at 40 flashes per minute and consist of from one to seven levels of lights depending upon the height of the structure. Where more than one level is used the vertical banks flash simultaneously.

53—59. RESERVED

NOTES

Section 3. AIRPORT MARKING AIDS

60. AIRPORT MARKING AIDS

a. In the interest of safety, regularity, or efficiency of aircraft operations, the FAA has recommended, for the guidance of the public, the following airport marking.

NOTE.— Refer to ADVISORY CIRCULAR—150/5340-1 Marking of Paved Areas on Airports for detailed airport marking information.

b. Runway designators — Runway numbers and letters are determined from the approach direction. The runway number is the whole number nearest one-tenth the magnetic azimuth of the centerline of the runway, measured clockwise from the magnetic north. The letter, or letters, differentiate between left (L), right (R), or center (C) parallel runways, as applicable:

(1) For two parallel runways "L" "R"

(2) For three parallel runways "L" "C" "R"

c. Visual Runway Marking — Used for operations under Visual Flight Rules:

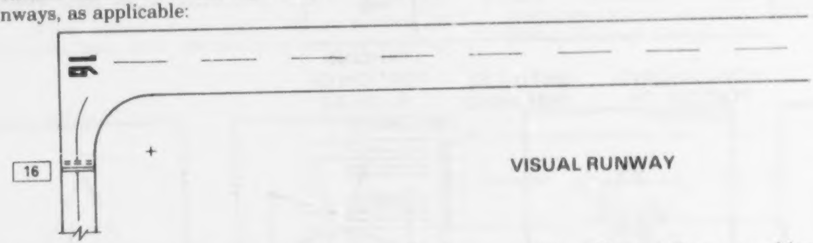
(1) Centerline marking.

(2) Designation marking.

(3) Threshold marking (on runways used or intended to be used by international commercial air transport.)

(4) Fixed distance marking (on runways 4,000 feet (1200 m) or longer used by jet aircraft.)

(5) Holding position markings (for taxiway/runway intersections.)



VISUAL RUNWAY

d. NonPrecision Instrument Runway Marking — Used on runways served by a nonvisual navigation aid and intended for landings under instrument weather conditions:

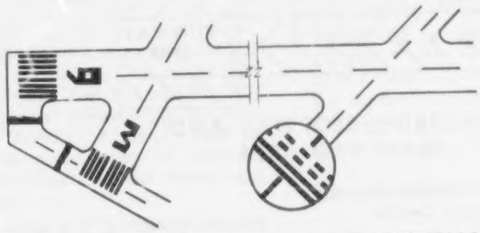
(1) Centerline marking.

(2) Designation marking.

(3) Threshold marking.

(4) Fixed distance marking (on runways 4,000 feet (1200 m) or longer used by jet aircraft.

(5) Holding position markings (for taxiway/runway intersections and instrument landing system (ILS) critical areas.)



NON-PRECISION INSTRUMENT RUNWAY

e. Precision Instrument Runway Marking — Used on runways served by nonvisual precision approach aids and on runways having special operational requirements:

(1) Centerline marking.

(2) Designation marking.

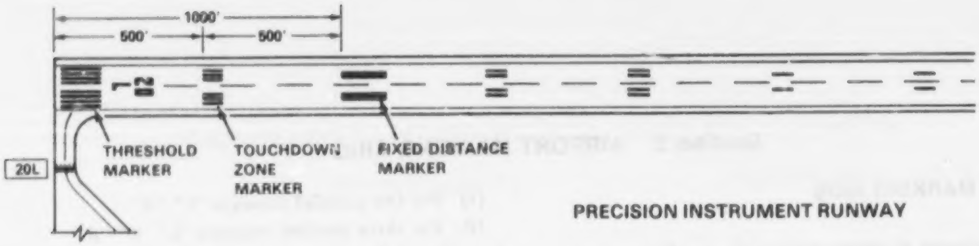
(3) Threshold marking.

(4) Fixed distance marking.

(5) Touchdown zone marking.

(6) Side stripes.

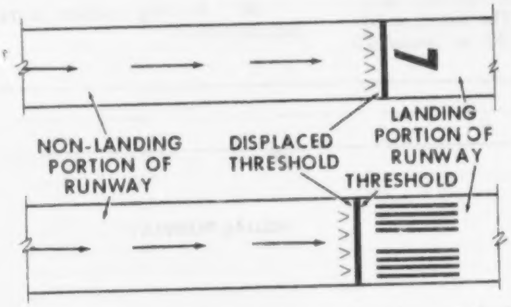
(7) Holding position markings (for taxiway/runway intersections and ILS critical areas.)


1000'
500'
500'
20L
THRESHOLD MARKER
TOUCHDOWN ZONE MARKER
FIXED DISTANCE MARKER

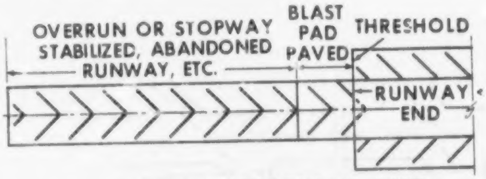
PRECISION INSTRUMENT RUNWAY

f. **Threshold** — The designated beginning of the runway that is available and suitable for the landing of aircraft.

g. **Displaced Threshold** — A threshold that is not at the beginning of the full strength runway pavement. The paved area behind the displaced runway threshold is available for taxiing, the landing rollout, and the takeoff of aircraft.

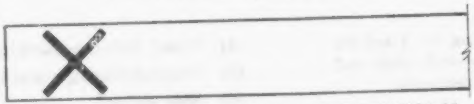

NON-LANDING PORTION OF RUNWAY
DISPLACED THRESHOLD
LANDING PORTION OF RUNWAY
THRESHOLD
7

h. **Overrun and Stopway Areas** — Any surface or area extending beyond the usable runway which appears usable but which, due to the nature of its structure, is unusable.


OVERRUN OR STOPWAY STABILIZED, ABANDONED RUNWAY, ETC.
BLAST PAD PAVED
THRESHOLD
RUNWAY END

1. OVERRUN/STOPWAY AND BLAST PAD AREA

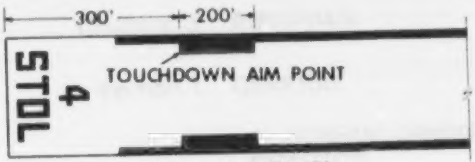
i. **Closed Runway** — A runway which is unusable and may be hazardous even though it may appear usable.



2. CLOSED RUNWAY OR TAXIWAY

j. Fixed Distance Marker — To provide a fixed distance marker for landing of turbojet aircraft on other than a precision instrument runway. This marking is similar to the fixed distance marking on a precision instrument runway and located 1,000 feet from the threshold.

k. STOL (Short Take Off and Landing) Runway — In addition to the normal runway number marking, the letters STOL are painted on the approach end of the runway and a touchdown aim point is shown.

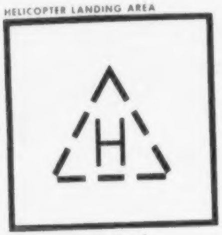


STOL RUNWAY

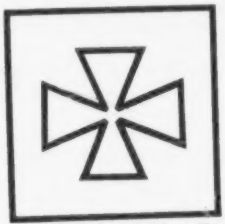
l. Taxiway Marking — The taxiway centerline is marked with a continuous yellow line. The taxiway edge may be marked with two continuous yellow lines 6 inches apart. Taxiway HOLDING LINES consist of two continuous and two dashed lines, spaced 6 inches between lines, perpendicular to the taxiway centerline; more recently, HOLD LINES also consist of one or more signs at the edge of the taxiway, with white characters on a red sign face.

NOTE.— When instructed by ATC "HOLD SHORT OF (runway, ILS critical area, etc.)," the pilot should stop so no part of the aircraft extends beyond the holding line. When approaching the holding line from the side with the continuous lines, a pilot should not cross the holding line without ATC clearance at a controlled airport or without making sure of adequate separation from other aircraft at uncontrolled airports. An aircraft exiting the runway is not clear until all parts of the aircraft have crossed the holding line.

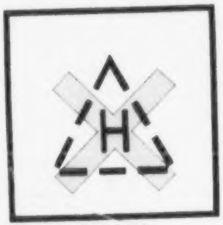
m. Helicopter Landing Areas — Details on heliport markings can be found in ADVISORY CIRCULAR—150/5390-1, Heliport Design Guide.



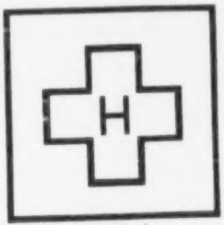
Recommended Marking for Civil Heliports



Some Civil and Military Heliports May Be Marked With This Symbol



Recommended Marking for Closed Heliports



Recommended Marking for Hospital Heliports

61. AIRCRAFT ARRESTING DEVICES

a. Certain airports are equipped with a means of rapidly stopping military aircraft on a runway. This equipment, normally referred to as EMERGENCY ARRESTING GEAR, generally consists of pendant cables supported over the runway surface by rubber "donuts". Although most devices are located in the overrun areas, a few of these arresting systems have cables stretched over the operational areas near the ends of a runway.

b. Arresting cables which cross over a runway require special markings on the runway to identify the cable location. These markings consist of 10 feet diameter solid circles painted "identification yellow", 30 feet on center, perpendicular to the runway centerline across the entire runway width. Additional details are contained in ADVISORY CIRCULAR—150/5220-9, Aircraft Arresting Systems for Joint/Civil Military Airports.

NOTE.— Aircraft operations on the runway are NOT restricted by the installation of aircraft arresting devices.

62—69. RESERVED

NOTES

Chapter 3. AIRSPACE

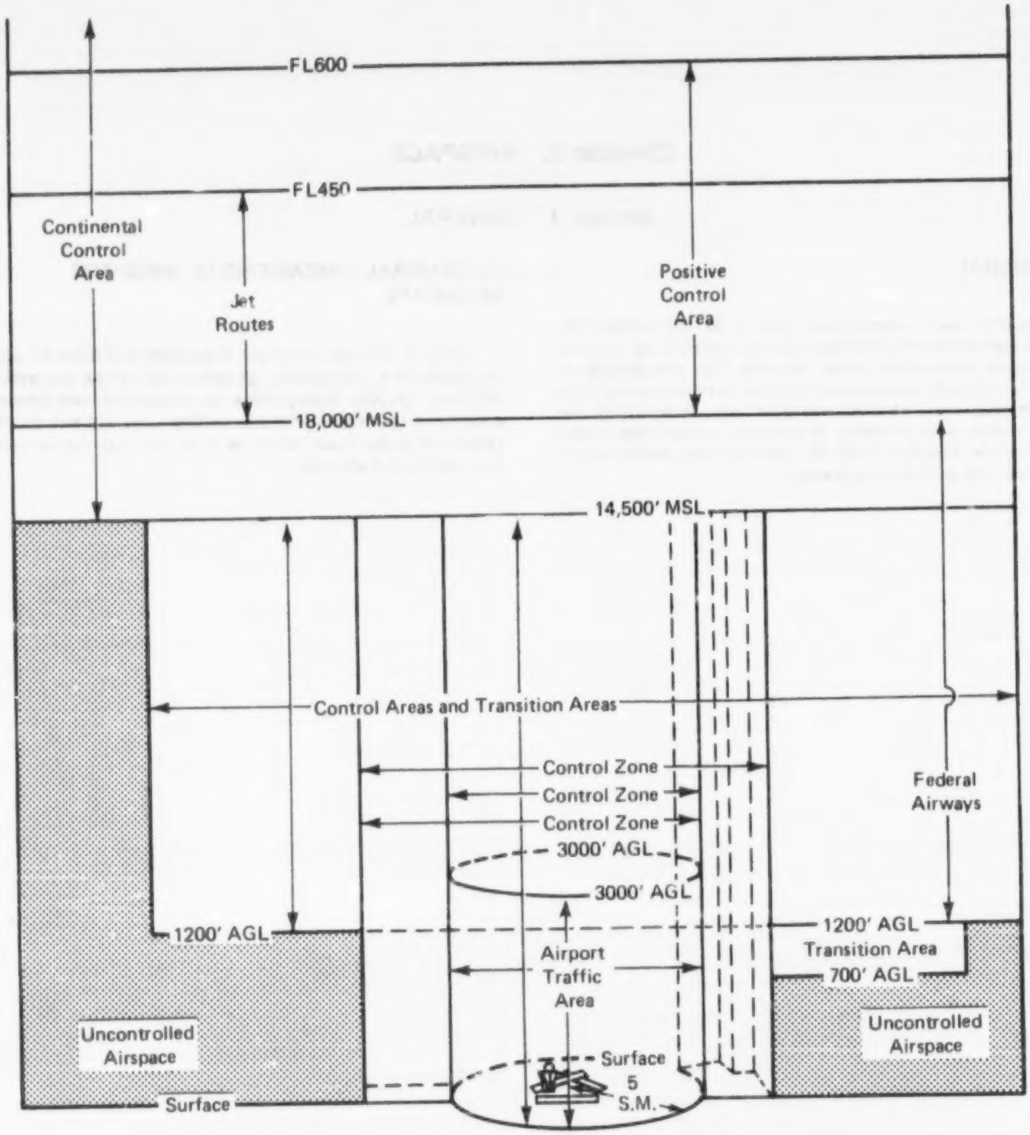
Section 1. GENERAL

70. GENERAL

Airspace users' operations and needs are varied. Because of the nature of some operations, restrictions must be placed upon others for safety reasons. The complexity or density of aircraft movements in other airspace areas may result in additional aircraft and pilot requirements for operation within such airspace. It is of the utmost importance that pilots be familiar with the operational requirements for the various airspace segments.

71. GENERAL DIMENSIONS OF AIRSPACE SEGMENTS

Refer to Federal Aviation Regulations (FARs) for specific dimensions, exceptions, geographical areas covered, exclusions, specific transponder or equipment requirements, and flight operations. Arrows ending near but not touching reference lines mean up to or down to, but not including, the referenced altitude.


FL600
FL450
Continental Control Area
Jet Routes
Positive Control Area
18,000' MSL
14,500' MSL
Control Areas and Transition Areas
Control Zone
Control Zone
Control Zone
Federal Airways
3000' AGL
3000' AGL
1200' AGL
1200' AGL
Transition Area
700' AGL
Airport Traffic Area
Uncontrolled Airspace
Uncontrolled Airspace
Surface
Surface
5 S.M.

72—79. RESERVED

Section 2. UNCONTROLLED AIRSPACE

80. GENERAL

Uncontrolled airspace is that portion of the airspace that has not been designated as Continental Control Area, Control Area, Control Zone, Terminal Control Area, or Transition Area.

81. VFR REQUIREMENTS

Rules governing VFR flight have been adopted to assist the pilot in meeting his responsibility to see and avoid other aircraft. Minimum weather conditions and distance from clouds required for VFR flight are contained in these rules. (FAR—91.105.)

82. IFR REQUIREMENTS

FARs specify the pilot and aircraft equipment requirements for IFR flight. Pilots are reminded that in addition to altitude or flight level requirements, FAR—91.119 includes a requirement to remain at least 1,000 feet (2,000 feet in designated mountainous terrain) above the highest obstacle within a horizontal distance of 5 statute miles from the course to be flown.

83. MINIMUM VFR VISIBILITY AND DISTANCE FROM CLOUDS

ALTITUDE	UNCONTROLLED AIRSPACE		CONTROLLED AIRSPACE	
	Flight Visibility	Distance From Clouds	**Flight Visibility	**Distance From Clouds
1200′ or less above the surface, regardless of MSL Altitude.	*1 statute mile	Clear of clouds	3 statute miles	500′ below 1000′ above 2000′ horizontal
More than 1200′ above the surface, but less than 10,000′ MSL.	1 statute mile	500′ below 1000′ above 2000′ horizontal	3 statute miles	500′ below 1000′ above 2000′ horizontal
More than 1200′ above the surface and at or above 10,000′ MSL.	5 statute miles	1000′ below 1000′ above 1 statute mile horizontal	5 statute miles	1000′ below 1000′ above 1 statute mile horizontal

*Helicopters may operate with less than 1 mile visibility, outside controlled airspace at 1200 feet or less above the surface, provided they are operated at a speed that allows the pilot adequate opportunity to see any air traffic or obstructions in time to avoid collisions.

**In addition, when operating within a control zone beneath a ceiling, the ceiling must not be less than 1000′. If the pilot intends to land or takeoff or enter a traffic pattern within a control zone, the ground visibility must be at least 3 miles at that airport. If ground visibility is not reported at the airport, 3 miles flight visibility is required. (FAR 91.105)

84. ALTITUDES AND FLIGHT LEVELS

CONTROLLED AND UNCONTROLLED AIRSPACE VFR ALTITUDES AND FLIGHT LEVELS

If your magnetic course (ground track) is	More than 3000′ above the surface but below 18,000′ MSL fly	Above 18,000′ MSL to FL 290 (except within Positive Control Area, FAR 71.193) fly	Above FL 290 (except within Positive Control Area, FAR 71.193) fly 4000′ intervals
0° to 179°	Odd thousands, MSL, plus 500′ (3500, 5500, 7500, etc.).	Odd Flight Levels plus 500′ (FL 195, FL 215, FL 235, etc.).	Beginning at FL 300 (FL 300, 340, 380, etc.)
180° to 359°	Even thousands, MSL, plus 500′ (4500, 6500, 8500, etc.).	Even Flight Levels plus 500′ (FL 185, FL 205, FL 225, etc.).	Beginning at FL 320 (FL 320, 360, 400, etc.)

UNCONTROLLED AIRSPACE - IFR ALTITUDES AND FLIGHT LEVELS

If your magnetic course (ground track) is	Below 18,000′ MSL fly	At or above 18,000′ MSL but below FL 290, fly	At or above FL 290, fly 4000′ intervals
0° to 179°	Odd thousands, MSL, (3000, 5000, 7000, etc.).	Odd Flight Levels, FL 190, 210, 230, etc.).	Beginning at FL 290, (FL 290, 330, 370, etc.)
180° to 359°	Even thousands, MSL, (2000, 4000, 6000, etc.).	Even Flight Levels (FL 180, 200, 220, etc.).	Beginning at FL 310, (FL 310, 350, 390, etc.)

85—89. RESERVED

Section 3. CONTROLLED AIRSPACE

90. GENERAL

Controlled airspace consists of those areas designated as Continental Control Area, Control Area, Control Zones, Terminal Control Areas and Transition Areas, within which some or all aircraft may be subject to ATC. Safety, users' needs, and volume of flight operations are some of the factors considered in the designation of controlled airspace. When so designated, the airspace is supported by ground to air communications, navigation aids, and air traffic services.

91. CONTINENTAL CONTROL AREA

a. The Continental Control Area consists of the airspace of the 48 contiguous States, the District of Columbia and Alaska, excluding the Alaska peninsula west of longitude 160 degrees 00 minutes 00 seconds W, at and above 14,500 feet MSL, but does not include:

(1) The airspace less than 1,500 feet above the surface of the earth; or

(2) Prohibited and Restricted areas, other than the Restricted areas listed in FAR—71 Subpart D.

92. CONTROL AREAS

Control Areas consist of the airspace designated as Colored Federal airways, VOR Federal airways, Additional Control Areas, and Control Area Extensions, but do not include the Continental Control Area. Unless otherwise designated, Control Areas also include the airspace between a segment of a main VOR airway and its associated alternate segments. The vertical extent of the various categories of airspace contained in Control Areas is defined in FAR—71.

93. POSITIVE CONTROL AREA

Positive Control Area is airspace so designated as positive control area in FAR—71.193. This area includes specified airspace within the conterminous U.S. from 18,000 feet to and including FL 600, excluding Santa Barbara Island, Farallon Island, and that portion south of latitude 25 degrees 04 minutes north. In Alaska, it includes the airspace over the State of Alaska from 18,000 feet to and including FL 600, but not including the airspace less than 1,500 feet above the surface of the earth and the Alaskan Peninsula west of longitude 160 degrees 00 minutes west. Rules for operating in Positive Control Area are found in FAR—91.97 and FAR—91.24.

94. TRANSITION AREAS

a. Transition Areas are designated to contain IFR operations in controlled airspace during portions of the terminal operation and while transitioning between the terminal and en route environments.

b. Transition Areas are controlled airspace extending upward from 700 feet or more above the surface when designated in conjunction with an airport for which an instrument approach procedure has been prescribed; or from 1,200 feet or more above the surface when designated in conjunction with airway route structures or segments. Unless specified otherwise, Transition Areas terminate at the base of overlying controlled airspace.

95. CONTROL ZONES

a. Control Zones are regulatory in nature and established as controlled airspace. They extend upward from the surface and terminate at the base of the Continental Control Area. Control Zones that do not underlie the Continental Control Area have no upper limit. A Control Zone is based on a primary airport but may include one or more airports and is normally a circular area within a radius of 5 statute miles around the primary airport, except that it may include extensions necessary to include instrument departure and arrival paths.

b. Some basic requirements for designating a control zone are communications and weather observation reporting:

(1) Communications capability with aircraft which normally operate within the control zone must exist down to the runway surface of the primary airport. Communications may be either direct from the ATC facility having jurisdiction over the control zone or by rapid relay through other communications facilities which are acceptable to that ATC facility.

(2) Federally certificated weather observers take hourly and special weather observations at the primary airport in the control zone during the times and dates a control zone is designated. The required weather observations must be forwarded expeditiously to the ATC facility having jurisdiction over the control zones.

c. Control Zones are depicted on charts (for example, on the Sectional Charts the Control Zone is outlined by a broken blue line). If a Control Zone is effective only during certain hours of the day (a part-time Control Zone as prescribed in the regulation) it will be reflected on the charts. A typical Control Zone is depicted in PARA—71. (See PARA—264 - SPECIAL VFR CLEARANCES.)

96. TERMINAL CONTROL AREA

a. A Terminal Control Area (TCA) consists of controlled airspace extending upward from the surface or higher to specified altitudes, within which **all aircraft** are subject to the operating rules and pilot and equipment requirements specified in FAR—91. TCAs are described in FAR—71. Each TCA location is designated as either a Group I or Group II TCA, and includes at least one primary airport around which the TCA is located. (See FAR—71.12.)

(1) Group I TCAs represent some of the busiest locations in terms of aircraft operations and passengers car-

ried. For reasons of safety it is necessary to have strict requirements for operation within Group I TCAs. (See FAR—91.70(c) and FAR—91.90.)

(2) Group II TCAs represent less busy locations, and though safety dictates some pilot and equipment requirements, requirements are not as stringent as those for Group I locations. (See FAR—91.70(c) and FAR—91.90.)

b. TCAs are charted on Sectional, World Aeronautical, En route Low Altitude, DOD FLIP and TCA Charts.

(1) The following areas are currently designated as Group I TCAs and are depicted on VFR Terminal Area Charts.

Atlanta
Boston
Chicago
Dallas
Los Angeles
Miami
New York
San Francisco
Washington, D.C.

(2) The following areas are currently designated as Group II TCAs and are depicted on VFR Terminal Area Charts.

Cleveland
Denver
Detroit
Honolulu
Houston
Kansas City
Las Vegas
Minneapolis
New Orleans
Philadelphia
Pittsburgh
Seattle
St. Louis
San Diego

97. TERMINAL CONTROL AREA (TCA) OPERATION

a. Operating Rules and Equipment Requirements. Regardless of weather conditions, ATC authorization is required prior to operating within a TCA. Pilots should not request such authorization unless the requirements of FAR—91.24 and FAR—91.90 are met. Included among these requirements are:

(1) Group I TCAs

(a) A two-way radio capable of communicating with ATC on appropriate frequencies.

(b) A VOR or TACAN receiver, except for helicopters.

(c) A 4096 code transponder with MODE C automatic altitude reporting equipment, except for helicopters operating at or below 1,000 feet AGL under a Letter of Agreement.

NOTE.— ATC may, upon notification, immediately authorize a deviation from the altitude reporting equipment requirement; however, request for a deviation from the 4096 transponder equipment requirement must be submitted to the controlling ATC facility at least 1 hour before the proposed operation.

(d) A private pilot certificate or better in order to land or takeoff from an airport within the TCA.

(e) Unless otherwise authorized by ATC, each person operating a large turbine engine powered airplane to or from a primary airport shall operate at or above the designated floors while within the lateral limits of the TCA.

(f) No person may operate an aircraft in the airspace underlying a TCA, at an indicated airspeed of more than 200 knots (230 mph) (FAR—91.70).

(2) Group II TCAs.

(a) A two-way radio capable of communicating with ATC on appropriate frequencies.

(b) A VOR or TACAN receiver, except for helicopters.

(c) A 4096 code transponder, except for helicopters operating at or below 1,000 feet under a Letter of Agreement, or for IFR flights operating to or from an airport outside of but in close proximity to the TCA when the commonly used transition, approach, or departure procedures to such airport require flight within the TCA.

NOTE.— ATC may authorize deviations from the transponder requirements. Requests for deviation must be submitted to the controlling ATC facility at least 1 hour before the proposed operation.

(d) Unless otherwise authorized by ATC, large turbine powered aircraft must operate at or above the floor of the TCA while operating to or from the primary airport.

(e) No person may operate an aircraft in the airspace underlying a TCA, at an indicated airspeed of more than 200 knots (230 mph) (FAR—91.70).

b. Flight Procedures.

(1) *IFR Flights.* Aircraft within the TCA are required to operate in accordance with current IFR procedures. A clearance for a visual approach to a primary airport is not authorization for turbine powered airplanes to operate below the designated floors of the TCA.

(2) *VFR Flights.*

(a) Arriving flights must contact ATC on the appropriate frequency and in relation to geographical fixes shown on local charts. Although a pilot may be operating

beneath the floor of the TCA on initial contact, communications with ATC should be established in relation to the points indicated for spacing and sequencing purposes.

(b) Departing aircraft require a clearance to depart the TCA and should advise the clearance delivery position of their intended altitude and route of flight. ATC will normally advise VFR aircraft when leaving the geographical limits of the TCA. Radar service is not automatically terminated with this advisory unless specifically stated by the controller.

(c) Aircraft not landing or departing the primary airport may obtain ATC clearance to transit the TCA when traffic conditions permit and provided the requirements of FAR—91.90 are met. Such VFR aircraft are encouraged, to the extent possible, to operate at altitudes above or below the TCA or transit through established VFR corridors. Pilots operating in VFR corridors are urged to use frequency 122.750 MHZ for the exchange of aircraft position information.

(d) VFR non-TCA aircraft are cautioned against operating too closely to TCA boundaries, especially where the floor of the TCA is 3,000 feet or less or where VFR cruise altitudes are at or near the floor of higher levels. Observance of this precaution will reduce the potential for encountering a TCA aircraft operating at TCA floor altitudes. Additionally, VFR non-TCA aircraft are encouraged to utilize the VFR Planning Chart as a tool for planning flight in proximity to a TCA. Charted VFR Flyway Planning charts are published on the back of the existing VFR Terminal Area Charts.

c. ATC Clearances and Separation. While operating within a TCA, pilots are provided the service and separation as in Stage III. (See PARA—165 - TERMINAL RADAR PROGRAM FOR VFR AIRCRAFT.) In the event of a radar outage, separation and sequencing of VFR aircraft will be suspended as this service is dependent on radar. The pilot will be advised that the service is not available and issued wind, runway information and the time or place to contact the tower. Traffic information will be provided on a workload permitting basis.

(1) Assignment of radar headings and/or altitudes to aircraft operating in accordance with visual flight rules are based on the provision that a pilot must request an amended clearance if compliance with an assigned route, radar heading or altitude will cause the pilot to violate Basic VFR Weather Minimums.

(2) ATC may assign altitudes to VFR aircraft that do not conform to FAR—91.109. When the altitude assignment is no longer needed for separation or when leaving the TCA, the instruction will be broadcast. "Resume Appropriate VFR Altitudes." Pilots must return to an altitude that conforms to FAR—91.109 as soon as practicable.

98. IFR ALTITUDES AND FLIGHT LEVELS

Pilots operating IFR within controlled airspace will fly at an altitude or flight level assigned by ATC. When operating IFR within controlled airspace with an altitude assignment of **VFR ON TOP**, flight is to be conducted at an appropriate VFR altitude which is not below the minimum IFR altitude for the route. (See PARA—84.) **VFR ON TOP** is not permitted in certain airspace areas, such as positive control airspace, certain Restricted Areas, etc. Consequently, IFR flights operating **VFR ON TOP** will avoid such airspace.

99. RESERVED

100. AIRPORT RADAR SERVICE AREA (ARSA)

a. An Airport Radar Service Area (ARSA) consists of controlled airspace extending upward from the surface or higher to specified altitudes, within which all aircraft are subject to the operating rules and pilot and equipment requirments specified in FAR—91. ARSAs are described in FAR—71. (See FAR—71.14.)

b. Dimensions

(1) *ARSA* (A basic standard design with minor site specific variations.) The ARSA airspace consists of two circles, both centered on the primary/ARSA airport. The inner circle has a radius of 5NM. The outer circle has a radius of 10NM. The airspace of the inner circle extends from the surface of the ARSA airport up to 4,000 feet above that airport. The airspace area between the 5 and 10NM rings begins at a height 1,200 feet AGL and extends to the same altitude cap as the inner circle.

(2) *OUTER AREA* The normal radius will be 20NM, with some variations based on site specific requirements. The outer area extends outward from the primary/ARSA airport and extends from the lower limits of radar/radio coverage up to the ceiling of the approach control's delegated airspace, excluding the ARSA and other airspace as appropriate.

c. ARSAs are charted on Sectional Charts, and some Terminal Control Area Charts.

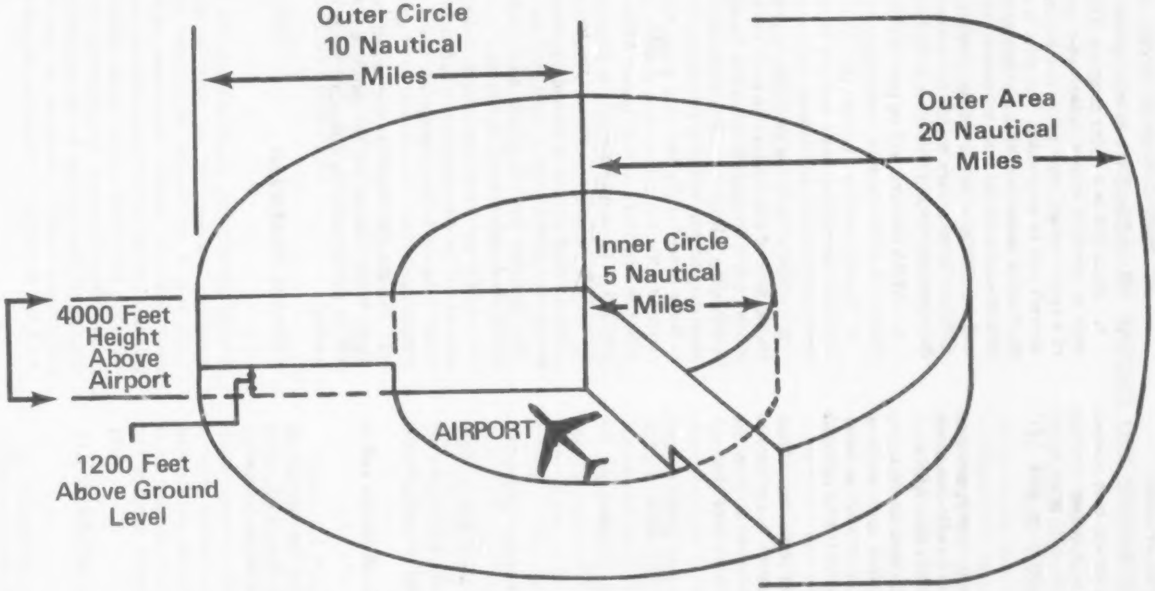
(1) The following areas are currently designated as ARSAs and are depicted on Sectional Charts.

STATE	CITY
ALASKA	Anchorage
CALIFORNIA	Burbank
	El Toro MCAS
	March AFB
	Ontario
CONNECTICUT	Windsor Locks (Bradley)
FLORIDA	Pensacola
	Whiting NAS
	Pensacola NAS
	Daytona Beach
	Ft. Lauderdale
	Jacksonville
	Orlando
	West Palm Beach
	Tampa
IOWA	Des Moines
MARYLAND	Baltimore
NEBRASKA	Omaha
	Offutt AFB
NEW YORK	Albany
	Islip
NORTH CAROLINA	Greensboro

STATE	CITY
OKLAHOMA	Tulsa Oklahoma City Tinker AFB
OHIO	Columbus Dayton
OREGON	Portland
TEXAS	Austin Corpus Christi El Paso Lubbock San Antonio
VIRGINIA	Norfolk Richmond

This list will be updated as additional ARSAs are implemented. Pilots should consult current sectional charts and NOTAMs for the latest information on services available. Pilots should be aware that some ARSAs underlie or are adjacent to TCAs.

Airport Radar Service Area (ARSA)


Outer Circle
10 Nautical
Miles
Outer Area
20 Nautical
Miles
Inner Circle
5 Nautical
Miles
4000 Feet
Height
Above
Airport
AIRPORT
1200 Feet
Above Ground
Level

Services upon establishing two-way radio communication and radar contact:

Sequencing Arrivals

IFR/IFR Standard Separation

IFR/VFR Traffic Advisories and Conflict Resolution

VFR/VFR Traffic Advisories

Note: The normal radius of the Outer Area, will be 20nm, with some site specific variations.

IFR: Instrument Flight Rules

VFR: Visual Flight Rules

101. AIRPORT RADAR SERVICE AREA (ARSA) OPERATION

a. Operating Rules and Pilot/Equipment Requirements

(1) Pilot Certification: Student Pilot or better.

(2) Equipment: Two-Way Radio.

(3) Arrivals and Overflights: No person may operate an aircraft in an airport radar service area unless two-way radio communication is established with ATC prior to entering that ARSA and is thereafter maintained with ATC, while within that area.

(4) Departures:

(a) Primary Airport: No person may operate an aircraft within the ARSA unless two-way radio communication is maintained with ATC while within that ARSA.

(b) Satellite Airports: Aircraft departing satellite airports/heliports within the ARSA surface area shall establish two-way communication with ATC as soon as possible. Pilots must comply with approved FAA traffic patterns when departing these airports.

(5) ULTRALIGHT VEHICLES: No person may operate an ultralight vehicle within an airport radar service area unless that person has prior authorization from the air traffic control facility having jurisdiction over that airspace. (FAR—103)

(6) Parachute Jumps: No person may make a parachute jump and no pilot in command may allow a parachute jump to be made from that aircraft in or into an airport radar service area without, or in violation of, the terms of an ATC authorization. (FAR—105)

b. ATC Services

(1) Within The ARSA:

(a) Sequencing of all arriving aircraft to the primary/ARSA airport.

(b) Standard IFR separation between IFR aircraft.

(c) Between IFR and VFR aircraft - traffic advisories and conflict resolution so that radar targets do not touch, or 500 feet vertical separation.

(d) Between VFR aircraft - traffic advisories and as appropriate, safety alerts.

(2) Within The Outer Area:

(a) The same services are provided for aircraft operating within the outer area, as within the ARSA, *when two-way communication and radar contact is established.*

(b) While pilot participation in this area is strongly encouraged, it is not a VFR requirement.

(3) Beyond The Outer Area:

(a) Standard IFR separation.

(b) Basic Radar Service.

(c) Stage II/Stage III Service, where appropriate.

(d) Safety Alert, as appropriate.

c. Since this is a radar program ARSA services will only be provided within radar/radio coverage. In the event of a radar outage, separation and sequencing of VFR aircraft will be suspended. The pilot will be advised that the service is not available and issued wind, runway information and the time to contact the tower.

d. While pilot participation is required within the ARSA, it is voluntary within the outer area and can be discontinued, within the outer area, at the pilots request.

e. ARSA services will be provided in the outer area unless the pilot requests termination of the service.

f. Service provided beyond the outer area will be on a workload permitting basis and can be terminated by the controller if workload dictates.

g. In some locations an ARSA may overlap the airport traffic area of a secondary airport. In order to allow that control tower to provide service to aircraft, portions of the overlapping ARSA may be procedurally excluded when the secondary airport tower is in operation. Aircraft operating in these procedurally excluded areas will only be provided airport traffic control services when in communication with the secondary airport tower. ARSA service to aircraft inbound to these airports will be discontinued when the aircraft is instructed to contact the tower.

h. Aircraft departing secondary controlled airports will not receive ARSA service until they have been radar identified and two-way communication has been established with the ARSA facility.

i. ARSA service to aircraft proceeding to a satellite airport will be terminated at a sufficient distance to allow time to change to the appropriate tower or advisory frequency.

j. Some ARSA facilities shut down for portions of the night. When this occurs, the effective hours of the ARSA will be the same as the operating hours of the serving facility.

102—109. RESERVED

Section 4. SPECIAL USE AIRSPACE

110. GENERAL

Special use airspace consists of that airspace wherein activities must be confined because of their nature, or wherein limitations are imposed upon aircraft operations that are not a part of those activities, or both. Except for Controlled Firing Areas, special use airspace areas are depicted on aeronautical charts.

111. PROHIBITED AREA

Prohibited Areas contain airspace of defined dimensions identified by an area on the surface of the earth within which the flight of aircraft is prohibited. Such areas are established for security or other reasons associated with the national welfare. These areas are published in the Federal Register and are depicted on aeronautical charts.

112. RESTRICTED AREA

Restricted Areas contain airspace identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Activities within these areas must be confined because of their nature or limitations imposed upon aircraft operations that are not a part of those activities or both. Restricted areas denote the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. Penetration of Restricted Areas without authorization from the using or controlling agency may be extremely hazardous to the aircraft and its occupants. Restricted Areas are published in the Federal Register and constitute FAR—73. (See PARA—346 - OPERATION IN RESTRICTED AIRSPACE.)

113. WARNING AREA

Warning Areas are airspace which may contain hazards to nonparticipating aircraft in international airspace. Warning Areas are established beyond the 3 mile limit. Though the activities conducted within Warning Areas may be as hazardous as those in Restricted Areas, Warning Areas cannot be legally designated as Restricted Areas because they are over international waters. Penetration of Warning Areas during periods of activity may be hazardous to the aircraft and its occupants. Official descriptions of Warning Areas may be obtained on request to the FAA, Washington, D.C.

114. MILITARY OPERATIONS AREAS (MOA)

a. MOAs consist of airspace of defined vertical and lateral limits established for the purpose of separating certain military training activities from IFR traffic. Whenever a MOA is being used, nonparticipating IFR traffic may be cleared through a MOA if IFR separation can be provided by ATC. Otherwise, ATC will reroute or restrict nonparticipating IFR traffic.

b. Most training activities necessitate acrobatic or abrupt flight maneuvers. Military pilots conducting flight in Department of Defense aircraft within a designated and active military operations area (MOA) are exempted from the provisions of FAR 91.71(c) and (d) which prohibit acrobatic flight within Federal airways and control zones.

c. Pilots operating under VFR should exercise extreme caution while flying within a MOA when military activity is being conducted. The activity status (active/inactive) of MOA's may change frequently. Therefore, pilots should contact any FSS within 100 miles of the area to obtain accurate real-time information concerning the MOA hours of operation. Prior to entering an active MOA, pilots should contact the controlling agency for traffic advisories.

d. MOA's are depicted on Sectional, VFR Terminal, Area and Low Altitude En Route Charts.

115. ALERT AREA

Alert Areas are depicted on aeronautical charts to inform nonparticipating pilots of areas that may contain a high volume of pilot training or an unusual type of aerial activity. Pilots should be particularly alert when flying in these areas. All activity within an Alert Area shall be conducted in accordance with FARs, without waiver, and pilots of participating aircraft as well as pilots transiting the area shall be equally responsible for collision avoidance. Information concerning these areas may be obtained upon request to the FAA, Washington, D.C.

116. CONTROLLED FIRING AREAS

Controlled Firing Areas contain activities which, if not conducted in a controlled environment, could be hazardous to nonparticipating aircraft. The distinguishing feature of the Controlled Firing Area, as compared to other special use airspace, is that its activities are suspended immediately when spotter aircraft, radar, or ground lookout positions indicate an aircraft might be approaching the area. There is no need to chart Controlled Firing Areas since they do not cause a nonparticipating aircraft to change its flight path.

117. PARACHUTE JUMP AIRCRAFT OPERATIONS

a. Procedures relating to parachute jump areas are contained in FAR—105. Tabulations of parachute jump areas in the U.S. are contained in the Airport/Facility Directory.

b. Pilots of aircraft engaged in parachute jump operations are reminded that all reported altitudes must be with reference to mean sea level, or flight level, as appropriate, to enable ATC to provide meaningful traffic information.

118—129. RESERVED

NOTES

Section 5. OTHER AIRSPACE AREAS

130. AIRPORT TRAFFIC AREAS

a. Unless otherwise specifically designated (FAR—93), Airport traffic areas consist of the airspace within a horizontal radius of 5 statute miles from the geographical center of any airport at which a control tower is operating, extending from the surface up to, but not including, an altitude of 3,000 feet above the elevation of the airport.

b. The rules prescribed for airport traffic areas are established in FAR—91.70, FAR—91.85, and FAR—91.87. They require, in effect, that unless a pilot is landing or taking off from an airport within the airport traffic area, *the pilot must avoid the area unless specifically authorized by ATC*, either directly from the ATC facility responsible for the airport traffic area, or from the facility from which the pilot is receiving radar services. When authorized by ATC to operate in an airport traffic area, the pilot may expect traffic advisory service on a workload-permitting basis.

c. Unless otherwise authorized, a pilot operating to or from an airport served by a control tower must: (1) establish and maintain radio communications with the tower prior to and while operating in the airport traffic area, (2) Maintain radio communications with the tower while operating on the movement areas of the airport. Maximum indicated airspeeds are prescribed. Airport traffic areas are indicated on VFR Navigation Charts by the blue airport symbol, but the actual boundary is not depicted. (See PARA—71 - GENERAL DIMENSIONS OF AIRSPACE SEGMENTS.)

131. AIRPORT ADVISORY AREA

a. The airport advisory area is the area within 10 statute miles of an airport where a control tower is not operating but where a FSS is located. At such locations, the FSS provides advisory service to arriving and departing aircraft. (See PARA—157 - TRAFFIC AIRPORT ADVISORY PRACTICES AT AIRPORTS WHERE A TOWER IS NOT IN OPERATION.)

b. It is not mandatory that pilots participate in the Airport Advisory Service program, but it is strongly recommended that they do.

132. MILITARY TRAINING ROUTES (MTR)

a. National security depends largely on the deterrent effect of our airborne military forces. To be proficient, the military services must train in a wide range of airborne tactics. One phase of this training involves "low level" combat tactics. The required maneuvers and high speeds are such that they may occasionally make the see-and-avoid aspect of VFR flight more difficult without increased vigilance in areas containing such operations. In an effort to ensure the greatest practical level of safety for all flight operations, the MTR program was conceived.

b. The MTRs program is a joint venture by the FAA and the Department of Defense (DOD). MTR routes are mutually developed for use by the military for the purpose of conducting low-altitude, high-speed training. The routes above 1,500 feet above ground level (AGL) are developed to be flown, to the maximum extent possible, under IFR. The routes at 1,500 feet AGL and below are generally developed to be flown under Visual Flight Rules (VFR).

c. Generally, MTRs are established below 10,000 feet MSL for operations at speeds in excess of 250 knots. However, route segments may be defined at higher altitudes for purposes of route continuity. For example, route segments may be defined for descent, climbout, and mountainous terrain. There are IFR and VFR routes as follows:

(1) IFR Military Training Routes — IR: Operations on these routes are conducted in accordance with IFRs regardless of weather conditions.

(2) VFR Military Training Routes — VR: Operations on these routes are conducted in accordance with VFRs.

d. Military training routes will be identified and charted as follows:

(1) Route identification.

(a) *IR and VR at or below 1,500 feet AGL* (with no segment above 1,500) will be identified by four digit numbers; e.g., IR 1006, VR 1007, etc.

(b) *IR and VR above 1,500 feet AGL* (segments of these routes may be below 1,500) will be identified by three digit numbers; e.g., IR 008, VR 009, etc.

(c) Alternate IR/VR routes or route segments are identified by using the basic/principal route designation followed by a letter suffix, e.g., IR008A, VR1007B, etc.

(2) Route charting.

(a) IFR Low Altitude En Route Chart — This chart will depict all IR routes and all VR routes that accommodate operations above 1,500 feet AGL.

(b) VFR Planning Chart — This chart will depict routes (military training activities such as IR and VR regardless of altitude@, MOAs, and restricted, warning and alert areas.

(c) Area Planning (AP/1B) Chart (DOD Flight Information Publication — FLIP. This chart is published by the DOD primarily for military users and contains detailed information on both IR and VR routes. (See PARA—625 - AUXILIARY CHARTS.)

e. The FLIP contains charts and narrative descriptions of these routes. This publication is available to the general public by single copy or annual subscription from the NOAA Distribution Branch, N/CG33 Riverdale, Maryland 20849. This DOD FLIP is available for pilot briefings at FSS and many airports.

f. Nonparticipating aircraft are not prohibited from flying within an MTR; however, extreme vigilance should be exercised when conducting flight through or near these routes. Pilots should contact FSSs within 100 NM of a particular MTR to obtain current information or route usage in their vicinity. Information available includes times of

scheduled activity, altitudes in use on each route segment, and actual route width. Route width varies for each MTR and can extend several miles on either side of the charted MTR centerline. Route width information for IR and VR MTR's is also available in the FLIP AP/1B along with additional MTR (SR/AR) information. When requesting MTR information, pilots should give the FSS their position, route of flight, and destination in order to reduce frequency congestion and permit the FSS specialist to identify the MTR routes which could be a factor.

133. TEMPORARY FLIGHT RESTRICTIONS

a. Temporary flight restrictions may be put into effect in the vicinity of any incident or event which by its nature may generate such a high degree of public interest that the likelihood of a hazardous congestion of air traffic exists. FAR—91.91, as amended, prohibits the operation of nonessential aircraft in airspace that has been designated in a NOTAM as an area within which temporary flight restrictions apply. This rule will be implemented in the case of disasters of substantial magnitude. It will also be implemented as necessary in the case of demonstrations, riots, and other civil disturbances, as well as major sporting events, parades, pageants, and similar functions which are likely to attract large crowds and encouraging viewing from the air. (See PARA—294 — NOTICE TO AIRMEN (NOTAM) SYSTEM.)

b. NOTAM's implementing temporary flight restrictions will contain a description of the area in which the restrictions apply. Normally the area will include the airspace below 2,000 feet above the surface within 5 miles of the site of the incident. However, the exact dimensions will be included in the NOTAM.

c. Pilots are not to operate aircraft within such an area described in the NOTAM unless they are one of the following:

(1) That aircraft is participating in disaster relief activities and is being operated under the direction of the agency responsible for relief activities;

(2) They are operating to or from an airport within the area and such operation will not hamper or endanger relief activities;

(3) Their operation is authorized under an IFR ATC clearance;

(4) Flight around the area is impracticable because of weather or other considerations and advance notice is given to the Air Traffic facility specified in the NOTAM, and en route flight through the area will not hamper or endanger relief activities; or

(5) They are carrying accredited news representatives or persons on official business concerning the incident, and the flight is conducted in accordance with FAR—91.79 and a flight plan is filed with the Air Traffic facility specified in the NOTAM.

d. Flight Limitations in the proximity of Space Flight Operations are designated in a Notice to Airman (NOTAM). FAR—91.102 provides protection from potentially hazardous situations for pilots and space flight crews and costly delays of shuttle operations.

e. Flight Restrictions in the proximity of Presidential and Other Parties are put into effect because numerous aircraft and large assemblies of persons may be attracted to areas to be visited or traveled by the President or Vice President, heads of foreign states, and other public figures. Such conditions may create a hazard to aircraft engaged in air commerce and to persons and property on the ground. In addition, responsible agencies of the United States Government may determine that certain regulatory actions should be taken in the interest of providing protection for these public figures. FAR—91.104 provides for the issuance of a regulatory NOTAM to establish flight restrictions where required in such cases.

134—149. RESERVED

Chapter 4. AIR TRAFFIC CONTROL

Section 1. SERVICES AVAILABLE TO PILOTS

150. AIR ROUTE TRAFFIC CONTROL CENTERS

Centers are established primarily to provide Air Traffic Service to aircraft operating on IFR flight plans within controlled airspace, and principally during the en route phase of flight.

151. CONTROL TOWERS

Towers have been established to provide for a safe, orderly and expeditious flow of traffic on and in the vicinity of an airport. When the responsibility has been so delegated, towers also provide for the separation of IFR aircraft in the terminal areas (See PARA—362 - APPROACH CONTROL.)

152. FLIGHT SERVICE STATIONS

FSSs are air traffic facilities which provide pilot briefings, en-route communications and VFR search and rescue services, assist lost aircraft and aircraft in emergency situations, relay ATC clearances, originate Notices to Airmen, broadcast aviation weather and NAS information, receive and process IFR flight plans, and monitor NAVAIDS. In addition, at selected locations FSSs provide En Route Flight Advisory Service (Flight Watch), take weather observations, issue airport advisories, and advise Customs and Immigration of transborder flights.

153. RECORDING AND MONITORING

a. Calls to air traffic control (ATC) facilities (ARTCCs, Towers, FSSs, Central Flow, and Communications Control Centers) over radio and ATC operational telephone lines (lines used for operational purposes such as controller instructions, briefings, opening and closing flight plans, issuance of IFR clearances and amendments, counter hijacking activities, etc.) may be monitored and recorded for operational uses such as accident investigations, accident prevention, search and rescue purposes, specialist training and evaluation, and technical evaluation and repair of control and communications systems.

b. Where the public access telephone is recorded, a beeper tone is not required. In place of the "beep" tone the FCC has substituted a mandatory requirement that persons to be recorded be given notice they are to be recorded and give consent. Notice is given by this entry, consent to record is assumsed by the individual placing a call to the operational facility.

154. COMMUNICATIONS RELEASE OF IFR AIRCRAFT LANDING AT AN AIRPORT NOT BEING SERVED BY AN OPERATING TOWER

Aircraft operating on an IFR flight plan, landing at an airport not being served by a tower will be advised to change to the airport advisory frequency when direct communications with ATC is no longer required. Towers and centers do not have nontower airport traffic and runway in use information. The instrument approach may not be aligned with the runway in use; therefore, if the information has not already been obtained, pilots should make an expeditious change to the airport advisory frequency when authorized. (See PARA—363-ADVANCE INFORMATION ON INSTRUMENT APPROACH.)

155. PILOT VISITS TO AIR TRAFFIC FACILITIES

Pilots are encouraged to visit air traffic facilities (Towers, Centers and FSSs) and participate in "Operation Raincheck". Operation Raincheck is a program designed to familiarize pilots with the ATC system, its functions, responsibilities and benefits. On rare occasions, facilities may not be able to approve a visit because of ATC workload or other reasons. It is therefore requested that pilots contact the facility prior to the visit and advise of the number of persons in the group, the time and date of the proposed visit and the primary interest of the group. With this information available, the facility can prepare an itinerary and have someone available to guide the group through the facility.

156. APPROACH CONTROL SERVICE FOR VFR ARRIVING AIRCRAFT

a. Numerous approach control facilities have established programs for arriving VFR aircraft to contact approach control for landing information. This information includes: wind, runway, and altimeter setting at the airport of intended landing. This information may be omitted if contained in the ATIS broadcast and the pilot states the appropriate ATIS code.

NOTE.— Pilot use of "have numbers" does not indicate receipt of the ATIS broadcast. In addition, the controller will provide traffic advisories on a workload permitting basis.

b. Such information will be furnished upon initial contact with concerned approach control facility. The pilot will be requested to change to the *tower* frequency at a predetermined time or point, to receive further landing information.

c. Where available, use of this procedure will not hinder the operation of VFR flights by requiring excessive spacing between aircraft or devious routing.

d. Compliance with this procedure is not mandatory but pilot participation is encouraged. (See PARA—165-TERMINAL RADAR PROGRAMS FOR VFR AIRCRAFT.)

157. TRAFFIC ADVISORY PRACTICES AT AIRPORTS WITHOUT OPERATING CONTROL TOWERS

a. Airport Operations Without Operating Control Tower

(1) There is no substitute for alertness while in the vicinity of an airport. It is essential that pilots be alert and look for other traffic and exchange traffic information when approaching or departing an airport without an operating control tower. This is of particular importance since other aircraft may not have communication capability or, in some cases, pilots may not communicate their presence or intentions when operating into or out of such airports. To achieve the greatest degree of safety, it is essential that all radio-equipped aircraft transmit/receive on a common frequency identified for the purpose of airport advisories.

(2) An airport may have a full or part-time tower or flight service station (FSS) located on the airport, a full or part-time UNICOM station or no aeronautical station at all. There are three ways for pilots to communicate their intention and obtain airport/traffic information when operating at an airport that does not have an operating tower: by communicating with an FSS, a UNICOM operator, or by making a self-announce broadcast.

b. Communicating on a Common Frequency.

(1) The key to communicating at an airport without an operating control tower is selection of the correct common frequency. The acronym *CTAF* which stands for Common Traffic Advisory Frequency, is synonymous with this program. A CTAF is a frequency designated for the purpose of carrying out airport advisory practices while operating to or from an airport without an operating control tower. The CTAF may be a UNICOM, MULTICOM, FSS, or tower frequency and is identified in appropriate aeronautical publications.

(2) The CTAF frequency for a particular airport is contained in the Airport/Facility Directory (A/FD), Alaska Supplement, Alaska Terminal Publication, Instrument Approach Procedure Charts, and Standard Instrument Departure (SID) charts. Also, the CTAF frequency can be obtained by contacting any FSS. Use of the appropriate CTAF, combined with a visual alertness and application of the following recommended good operating practices, will enhance safety of flight into and out of all uncontrolled airports.

c. Recommended Traffic Advisory Practices.

All inbound traffic should monitor and communicate as appropriate on the designated CTAF from 10 miles to landing. Departing aircraft should monitor/communicate on the appropriate frequency from start-up, during taxi, and until 10 miles from the airport unless the FARs or local procedures require otherwise.

d. Airport Advisory Service Provided by an FSS.

(1) Airport Advisory Service (AAS) is a service provided by an FSS physically located on an airport which does not have a control tower or where the tower is operated on a part-time basis. The CTAF for FSSs which provide this service will be disseminated in appropriate aeronautical publications.

(2) In communicating with a CTAF FSS, establish two-way communications before transmitting outbound/inbound intentions or information. An inbound aircraft should report approximately 10 miles from the airport, reporting altitude and aircraft type, location relative to the airport, state whether landing or overflight, and request airport advisory. Departing aircraft should state the aircraft type, full identification number, type of flight planned, i.e., VFR or IFR and the planned destination or direction of flight. Report before taxiing and before taxiing on the runway for departure. If communications with a UNICOM are necessary after initial report to FSS, return to FSS frequency for traffic update.

(a) Inbound

EXAMPLE:

> VERO BEACH RADIO, CENTURION SIX NINER DELTA DELTA IS TEN MILES SOUTH, TWO THOUSAND, LANDING VERO BEACH. REQUEST AIRPORT ADVISORY.

(b) Outbound

EXAMPLE:

> VERO BEACH RADIO, CENTURION SIX NINER DELTA DELTA, READY TO TAXI, VFR, DEPARTING TO THE SOUTHWEST. REQUEST AIRPORT ADVISORY.

(3) A CTAF FSS provides wind direction and velocity, favored or designated runway, altimeter setting, known traffic, notices to airmen, airport taxi routes, airport traffic pattern information, and instrument approach procedures. These elements are varied so as to best serve the current traffic situation. Some airport managers have specified that under certain wind or other conditions designated runways be used. Pilots should advise the FSS of the runway they intend to use.

CAUTION: All aircraft in the vicinity of an airport may not be in communication with the FSS.

e. Information Provided by Aeronautical Advisory Stations (UNICOM).

(1) UNICOM is a nongovernment air/ground radio communication station which may provide airport information at public use airports where there is no tower or FSS.

(2) On pilot request, UNICOM stations may provide pilots with weather information, wind direction, the recommended runway, or other necessary information. If the UNICOM frequency is designated as the CTAF, it will be identified in appropriate aeronautical publications.

(3) Should AAS by an FSS or, Aeronautical Advisory Station (UNICOM) be unavailable, wind and weather information may be obtainable from nearby controlled airports via Automatic Terminal Information Service (ATIS) or Automated Weather Observing System (AWOS) frequency.

f. Self-Announce Position and/or Intentions.

(1) General. *Self-announce* is a procedure whereby pilots broadcast their position or intended flight activity or ground operation on the designated CTAF. This procedure is used primarily at airports which do not have an FSS on the airport. The self-announce procedure should also be used if a pilot is unable to communicate with the FSS on the designated CTAF.

(2) If an airport has a tower and it is temporarily closed, or operated on a part-time basis and there is no FSS on the airport or the FSS is closed, use the CTAF to self-announce your position or intentions.

(3) Where there is no tower, FSS, or UNICOM station on the airport, use MULTICOM frequency 122.9 for self-announce procedures. Such airports will be identified in appropriate aeronautical information publications.

(4) Practice Approaches. Pilots conducting practice instrument approaches should be particularly alert for other aircraft that may be departing in the opposite direction. When conducting any practice approach, regardless of its direction relative to other airport operations, pilots should make announcements on the CTAF as follows:

(a) departing the final approach fix, inbound (non precision approach) or departing the outer marker or fix used in lieu of the outer marker, inbound (precision approach);

(b) established on the final approach segment or immediately upon being released by ATC;

(c) upon completion or termination of the approach; and

(d) upon executing the missed approach procedure.

(5) Departing aircraft should always be alert for arrival aircraft coming from the opposite direction.

(6) Recommended Self—Announce Phraseologies: It should be noted that aircraft operating to or from another nearby airport may be making self-announce broadcasts on the same UNICOM or MULTICOM frequency. To help identify one airport from another, the airport name should be spoken at the beginning and end of each self-announce transmission.

(a) Inbound

EXAMPLE:

STRAWN TRAFFIC, APACHE TWO TWO FIVE ZULU, (POSITION), (ALTITUDE), (DESCENDING) OR ENTERING DOWNWIND/BASE/FINAL (AS APPROPRIATE) RUNWAY ONE SEVEN FULL STOP, TOUCH-AND-GO, STRAWN.

STRAWN TRAFFIC APACHE TWO TWO FIVE ZULU LEAVING RUNWAY ONE SEVEN STRAWN.

(b) Outbound

EXAMPLE:

STRAWN TRAFFIC, QUEEN AIR SEVEN ONE FIVE FIVE BRAVO (LOCATION ON AIRPORT) TAXIING TO RUNWAY TWO SIX STRAWN.

STRAWN TRAFFIC, QUEEN AIR SEVEN ONE FIVE FIVE BRAVO DEPARTING RUNWAY TWO SIX. "DEPARTING THE PATTERN TO THE (DIRECTION), CLIMBING TO (ALTITUDE) STRAWN."

(c) Practice Instrument Approach

EXAMPLE:

STRAWN TRAFFIC, CESSNA TWO ONE FOUR THREE QUEBEC (NAME - FINAL APPROACH FIX) INBOUND DESCENDING THROUGH (ALTITUDE) PRACTICE (TYPE) APPROACH RUNWAY THREE FIVE STRAWN.

STRAWN TRAFFIC, CESSNA TWO ONE FOUR THREE QUEBEC PRACTICE (TYPE) APPROACH COMPLETED OR TERMINATED RUNWAY THREE FIVE STRAWN.

g. UNICOM Communications Procedures.

(1) In communicating with a UNICOM station, the following practices will help reduce frequency congestion, facilitate a better understanding of pilot intentions, help identify the location of aircraft in the traffic pattern, and enhance safety of flight:

(a) Select the correct UNICOM frequency.

(b) State the identification of the UNICOM station you are calling in each transmission.

(c) Speak slowly and distinctly.

(d) Report approximately 10 miles from the airport, reporting altitude, and state your aircraft type, aircraft idenification, location relative to the airport, state whether landing or overflight, and request wind information and runway in use.

(e) Report on downwind, base, and final approach.

(f) Report leaving the runway.

(2) Recommended UNICOM Phraseologies:

(a) Inbound

EXAMPLE:

FREDERICK UNICOM CESSNA EIGHT ZERO ONE TANGO FOXTROT 10 MILES SOUTHEAST DESCENDING THROUGH (ALTITUDE) LANDING FREDERICK, REQUEST WIND AND RUNWAY INFORMATION FREDERICK.

FREDERICK TRAFFIC CESSNA EIGHT ZERO ONE TANGO FOXTROT ENTERING DOWNWIND/BASE/FINAL (AS APPROPRIATE) FOR RUNWAY ONE NINE FULL STOP, TOUCH-AND-GO FREDERICK.

FREDERICK TRAFFIC CESSNA EIGHT ZERO ONE TANGO FOXTROT LEAVING RUNWAY ONE NINE FREDERICK.

(b) Outbound

EXAMPLE:

FREDERICK UNICOM CESSNA EIGHT ZERO ONE TANGO FOXTROT (LOCATION ON AIRPORT) TAXIING TO RUNWAY ONE NINE, REQUEST WIND AND TRAFFIC INFORMATION FREDERICK.

FREDERICK TRAFFIC CESSNA EIGHT ZERO ONE TANGO FOXTROT DEPARTING RUNWAY ONE NINE. "REMAINING IN THE PATTERN" OR "DEPARTING THE PATTERN TO THE (DIRECTION) (AS APPROPRIATE)" FREDERICK.

SUMMARY OF RECOMMENDED COMMUNICATION PROCEDURES

	FACILITY AT AIRPORT	FREQUENCY USE	COMMUNICATION/BROADCAST PROCEDURES		
			OUTBOUND	*INBOUND*	*PRACTICE INSTRUMENT APPROACH*
1.	UNICOM (No Tower or FSS)	Communicate with UNICOM station on published CTAF frequency (122.7, 122.8, 122.725, 122.975, or 123.0). If unable to contact UNICOM station, use self-announce procedures on CTAF.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	
2.	No Tower, FSS, or UNICOM	Self-announce on MULTICOM frequency 122.9.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	Departing final approach fix (name) or on final approach segment inbound.
3.	No Tower in operation, FSS open	Communicate with FSS on CTAF frequency.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	Approach completed/terminated.
4.	FSS closed (No Tower)	Self-announce on CTAF.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	
5.	Tower or FSS not in operation	Self-announce on CTAF.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	

158. IFR APPROACHES/GROUND VEHICLE OPERATIONS

a. IFR Approaches.

When operating in accordance with an IFR clearance and ATC approves a change to the advisory frequency, make an expeditious change to the CTAF and employ the recommended traffic advisory procedures.

b. Ground Vehicle Operation.

Airport ground vehicles equipped with radios should monitor the CTAF frequency when operating on the airport movement area and remain clear of runways/taxiways being used by aircraft. Radio transmissions from ground vehicles should be confined to safety-related matters.

c. Radio Control of Airport Lighting Systems.

Whenever possible, the CTAF will be used to control airport lighting systems at airports without operating control towers. This eliminates the need for pilots to change frequencies to turn the lights on and allows a continuous listening watch on a single frequency. The CTAF is published on the instrument approach chart and in other appropriate aeronautical information publications. For further details concerning radio controlled lights, see AC 150/5340.27.

159. DESIGNATED UNICOM/MULTICOM FREQUENCIES

a. Communications Between Aircraft.

CAUTION—The Federal Communications Commission (FCC) requires an aircraft station license to operate on UNICOM/MULTICOM frequencies and usage must be in accordance with Part 87 of the FCC Rules (See Section 87.29 regarding license applications). Misuse of these frequencies may result in either the imposition of fines and/or revocation/suspension of FCC aircraft station license.

b. Frequency Use.

The following listing depicts UNICOM and MULTI-

COM frequency uses as designated by the Federal Communications Commission (FCC).

FREQUENCY	USE
122.700	Airports without an operating control tower
122.725	Airports without an operating control tower
122.800	Airports without an operating control tower
123.000	Airports without an operating control tower
122.975	Airports without an operating control tower
122.900	(MULTICOM frequency) Airports with no tower, FSS, or UNICOM
122.950	Airports with a control tower
122.725	Private airports (not open to public)
122.975	High altitude
123.050	Heliports
123.075	Heliports

NOTE— In some areas of the country, frequency interference may be encountered from nearby airports using the same UNICOM frequency. Where this is a problem, UNICOM operators are encouraged to develop a *least interference* frequency assignment plan for airports concerned using the five frequencies designated for airports without operating control towers. UNICOM licensees may then request FCC to assign frequencies in accordance with the plan, which they will review and consider for approval.

160. USE OF UNICOM FOR ATC PURPOSES

UNICOM service may be used for air traffic control purposes, only under the following circumstances:

(1) Revision to proposed departure time.

(2) Takeoff, arrival, or flight plan cancellation time.

(3) ATC clearance, provided arrangements are made between the ATC facility and the UNICOM licensee to handle such messages.

161. AUTOMATIC TERMINAL INFORMATION SERVICE (ATIS)

a. ATIS is the continuous broadcast of recorded noncontrol information in selected high activity terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information. Pilots are urged to cooperate in the ATIS program as it relieves frequency congestion on approach control, ground control, and local control frequencies. The Airport Facility/Directory indicates airports for which ATIS is provided.

b. ATIS information includes the time of the latest weather sequence, ceiling, visibility (if the weather is above a ceiling/sky condition of 5,000 feet and the visibility is 5 miles or more, inclusion of the ceiling/sky condition, visibility, and obstructions to vision in the ATIS message is optional), obstructions to visibility, temperature, dew point (if available), wind direction (magnetic) and velocity, altimeter, other pertinent remarks, instrument approach and runways in use is continuously broadcast on the voice feature of a TVOR/VOR/VORTAC located on or near the airport, or in a discrete VHF/UHF frequency. The departure runway will only be given if different from the landing runway except at locations having a separate ATIS for departure. Where VFR arrival aircraft are expected to make initial contact with approach control, this fact and the appropriate frequencies may be broadcast on ATIS. Pilots of aircraft arriving or departing the terminal area can receive the continuous ATIS broadcasts at times when cockpit duties are least pressing and listen to as many repeats as desired. ATIS broadcasts shall be updated upon the receipt of any official weather, regardless of content change and reported values. A new recording will also be made when there is a change in other pertinent data such as runway change, instrument approach in use, etc.

EXAMPLE:

DULLES INTERNATIONAL INFORMATION SIERRA. 1300 UTC WEATHER. MEASURED CEILING THREE THOUSAND OVERCAST. VISIBILITY THREE, SMOKE. TEMPERATURE SIX EIGHT. WIND THREE FIVE ZERO AT EIGHT. ALTIMETER TWO NINER NINER TWO. ILS RUNWAY ONE RIGHT APPROACH IN USE. LANDING RUNWAY ONE RIGHT AND LEFT. DEPARTURE RUNWAY THREE ZERO. ARMEL VORTAC OUT OF SERVICE. ADVISE YOU HAVE SIERRA.

c. Pilots should listen to ATIS broadcasts whenever ATIS is in operation.

d. Pilots should notify controllers on initial contact that they have received the ATIS broadcast by repeating the alphabetical code word appended to the broadcast.

EXAMPLE:

"INFORMATION SIERRA RECEIVED."

e. When the pilot acknowledges that he has received the ATIS broadcast, controllers may omit those items contained in the broadcast if they are current. Rapidly changing conditions will be issued by ATC and the ATIS will contain words as follows:

EXAMPLE:

"LATEST CEILING/VISIBILITY/ALTIMETER/WIND/(other conditions) WILL BE ISSUED BY APPROACH CONTROL/TOWER."

NOTE.— The absence of a sky condition or ceiling and/or visibility on ATIS indicates a sky condition or ceiling of 5,000 feet or above and visibility of 5 miles or more. A remark may be made on the broadcast, "The weather is better than 5000 and 5," or the existing weather may be broadcast.

f. Controllers will issue pertinent information to pilots who do not acknowledge receipt of a broadcast or who acknowledge receipt of a broadcast which is not current.

g. To serve frequency limited aircraft, FSSs are equipped to transmit on the omnirange frequency at most en route VORs used as ATIS voice outlets. Such communication interrupts the ATIS broadcast. Pilots of aircraft equipped to receive on other FSS frequencies are encouraged to do so in order that these override transmissions may be kept to an absolute minimum.

h. While it is a good operating practice for pilots to make use of the ATIS broadcast where it is available, some pilots use the phrase "Have Numbers" in communications with the control tower. Use of this phrase means that the pilot has received wind, runway, and altimeter information ONLY and the tower does not have to repeat this informa-

tion. It does not indicate receipt of the ATIS broadcast and should never be used for this purpose.

162. RADAR TRAFFIC INFORMATION SERVICE

This is a service provided by radar ATC facilities. Pilots receiving this service are advised of any radar target observed on the radar display which may be in such proximity to the position of their aircraft or its intended route of flight that it warrants their attention. This service is not intended to relieve the pilot of his responsibility for continual vigilance to see and avoid other aircraft.

a. Purpose of the Service:

(1) The issuance of traffic information as observed on a radar display is based on the principle of assisting and advising a pilot that a particular radar target's position and track indicates it may intersect or pass in such proximity to his intended flight path that it warrants his attention. This is to alert the pilot to the traffic so that he can be on the lookout for it and thereby be in a better position to take appropriate action should the need arise.

(2) Pilots are reminded that the surveillance radar used by ATC does not provide altitude information unless the aircraft is equipped with MODE C and the Radar Facility is capable of displaying altitude information.

b. Provisions of the Service:

(1) Many factors, such as limitations of the radar, volume of traffic, controller workload and communications frequency congestion, could prevent the controller from providing this service. The controller possesses complete discretion for determining whether he is able to provide or continue to provide this service in a specific case. His reason against providing or continuing to provide the service in a particular case is not subject to question nor need it be communicated to the pilot. In other words, the provision of this service is entirely dependent upon whether the controller believes he is in a position to provide it. Traffic information is routinely provided to all aircraft operating on IFR Flight Plans except when the pilot advises he does not desire the service, or the pilot is operating within positive controlled airspace. Traffic information may be provided to flights not operating on IFR Flight Plans when requested by pilots of such flights.

NOTE.— Radar ATC facilities normally display and monitor both primary and secondary radar when it is available, except that secondary radar may be used as the sole display source in Positive Control Airspace (PCA), and under some circumstances outside of PCA (beyond primary coverage and in en route areas where only secondary is available). Secondary radar may also be used outside PCA as the sole display source when the primary radar is temporarily unusable or out of service. Pilots in contact with the affected ATC facility are normally advised when a temporary outage occurs; i.e., "primary radar out of service; traffic advisories available on transponder aircraft only." This means simply that only the aircraft which have transponders installed and in use will be depicted on ATC radar indicators when the primary radar is temporarily out of service.

(2) When receiving VFR radar advisory service, pilots should monitor the assigned frequency at all times. This is to preclude controllers' concern for radio failure or emergency assistance to aircraft under his jurisdiction. VFR radar advisory service does not include vectors away from conflicting traffic unless requested by the pilot. When advisory service is no longer desired, advise the controller before changing frequencies and then change your transponder code to 1200, if applicable. Pilots should also inform the controller when changing VFR cruising altitude. Except in programs where radar service is automatically terminated, the controller will advise the aircraft when radar is terminated.

NOTE.— Participation by VFR pilots in formal programs implemented at certain terminal locations constitutes pilot request. This also applies to participating pilots at those locations when arriving VFR flights are encouraged to make their first contact with the tower on the approach control frequency.

c. Issuance of Traffic Information — Traffic information will include the following concerning a target which may constitute traffic for an aircraft that is:

(1) Radar identified:

(a) Azimuth from the aircraft in terms of the 12 hour clock, or

(b) When rapidly maneuvering civil test or military aircraft prevent accurate issuance of traffic as in (a) above, specify the direction from an aircraft's position in terms of the eight cardinal compass points (N,NE,E,SE,S,SW,W,NW). This method shall be terminated at the pilot's request.

(c) Distance from the aircraft in nautical miles;

(d) Direction in which the target is proceeding; and

(e) Type of aircraft and altitude if known.

EXAMPLE:

Traffic 10 o'clock, 3 miles, west-bound (type aircraft and altitude, if known, of the observed traffic). The altitude may be known, by means of MODE C, but not verified with the pilot for accuracy. (To be valid for separation purposes by ATC, the accuracy of MODE C readouts must be verified. This is usually accomplished upon initial entry into the radar system by a comparison of the readout to pilot stated altitude, or the field elevation in the case of continuous readout being received from an aircraft on the airport.) When necessary to issue traffic advisories containing unverified altitude information, the controller will issue the advisory in the same manner as if it were verified due to the accuracy of these readouts. The pilot may upon receipt of traffic information, request a vector (heading) to avoid such traffic. The vector will be provided to the extent possible as determined by the controller provided the aircraft to be vectored is within the airspace under the jurisdiction of the controller.

(2) Not radar identified:

(a) Distance and direction with respect to a fix;

(b) Direction in which the target is proceeding; and

(c) Type of aircraft and altitude if known.

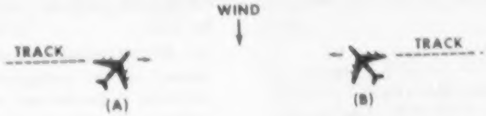
EXAMPLE:

Traffic 8 miles south of the airport northeastbound (type aircraft and altitude if known).

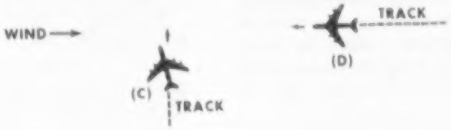
d. The examples depicted in the following figures point out the possible error in the position of this traffic when it is necessary for a pilot to apply drift correction to maintain this track. This error could also occur in the event a change in course is made at the time radar traffic information is issued.

(1) In this figure traffic information would be issued to the pilot of aircraft "A" as 12 o'clock. The actual posi

tion of the traffic as seen by the pilot of aircraft "A" would be 2 o'clock. Traffic information issued to aircraft "B" would also be given as 12 o'clock, but in this case, the pilot of "B" would see his traffic at 10 o'clock.



(2) In this figure traffic information would be issued to the pilot of aircraft "C" as 2 o'clock. The actual position of the traffic as seen by the pilot of aircraft "C" would be 3 o'clock. Traffic information issued to aircraft "D" would be at an 11 o'clock position. Since it is not necessary for the pilot of aircraft "D" to apply wind correction (crab) to make good his track, the actual position of the traffic issued would be correct. Since the radar controller can only observe aircraft track (course) on his radar display, he must issue traffic advisories accordingly, and pilots should give due consideration to this fact when looking for reported traffic.



163. SAFETY ALERT

A safety alert will be issued to pilots of aircraft being controlled by ATC if the controller is aware the aircraft is at an altitude which, in the controller's judgment, places the aircraft in unsafe proximity to terrain, obstructions or other aircraft. The provision of this service is contingent upon the capability of the controller to have an awareness of a situation involving unsafe proximity to terrain, obstructions and uncontrolled aircraft. The issuance of a safety alert cannot be mandated, but it can be expected on a reasonable, though intermittent basis. Once the alert is issued, it is solely the pilot's prerogative to determine what course of action, if any, he will take. This procedure is intended for use in time critical situations where aircraft safety is in question. Noncritical situations should be handled via the normal traffic alert procedures.

a. Terrain or Obstruction Alert:

(1) The controller will immediately issue an alert to the pilot of an aircraft under his control when he recognizes that the aircraft is at an altitude which, in his judgment, may be in unsafe proximity to terrain/obstructions. The primary method of detecting unsafe proximity is through MODE C automatic altitude reports.

EXAMPLE:

LOW ALTITUDE ALERT, CHECK YOUR ALTITUDE IMMEDIATELY. THE, as appropriate, MEA/MVA/MOCA IN YOUR AREA IS (altitude) or, if past the final approach fix (non precision approach) or the outer marker or fix used in lieu of the outer marker (precision approach), THE, as appropriate, MDA/DH (if known) is (altitude).

(2) Terminal ARTS IIA, III, AND IIIA facilities have an automated function which, if operating, alerts the controller when a tracked MODE C equipped aircraft under his control is below or is predicted to be below a predetermined minimum safe altitude. This function, called Minimum Safe Altitude Warning (MSAW), is designed solely as a controller aid in detecting potentially unsafe aircraft proximity to terrain/obstructions. The ARTS IIA, III, and IIIA facility will, when MSAW is operating, provide MSAW monitoring for all aircraft with an operating MODE C altitude encoding transponder that are tracked by the system and are:

(a) Operating on an IFR flight plan, or

(b) Operating VFR and have requested MSAW monitoring.

(3) Terminal AN/TPX-42A (number beacon decoder system) facilities have an automated function called Low Altitude Alert System (LAAS). Although not as sophisticated as MSAW, LAAS alerts the controller when a MODE C transponder equipped aircraft operating on an IFR flight plan is below a predetermined minimum safe altitude.

NOTE.— Pilots operating VFR may request MSAW or LAAS monitoring if their aircraft are equipped with MODE C transponders.

EXAMPLE:

APACHE THREE THREE PAPA REQUEST MSAW/LAAS.

b. Aircraft Conflict Alert:

(1) The controller will immediately issue an alert to the pilot of an aircraft under his control if he is aware of another aircraft which is not under his control is at an altitude which, in the controller's judgment, places both aircraft in unsafe proximity to each other. With the alert,

when feasible, the controller will offer the pilot the position of the traffic if time permits and an alternate course(s) of action. Any alternate course(s) of action the controller may recommend to the pilot will be predicated only on other traffic under his control.

EXAMPLE:

AMERICAN THREE, TRAFFIC ALERT, (position of traffic, if time permits), ADVISE YOU TURN RIGHT/LEFT HEADING (degrees) AND/OR CLIMB/DESCEND TO (altitude) IMMEDIATELY.

164. RADAR ASSISTANCE TO VFR AIRCRAFT

a. Radar equipped FAA ATC facilities provide radar assistance and navigation service (vectors) to VFR aircraft provided the aircraft can communicate with the facility, are within radar coverage, and can be radar identified.

b. Pilots should clearly understand that authorization to proceed in accordance with such radar navigational assistance does not constitute authorization for the pilot to violate FARs. In effect, assistance provided is on the basis that navigational guidance information issued is advisory in nature and the job of flying the aircraft safely, remains with the pilot.

c. In many cases, the controller will be unable to determine if flight into instrument conditions will result from his instructions. To avoid possible hazards resulting from being vectored into IFR conditions, pilots should keep the controller advised of the weather conditions in which he is operating and along the course ahead.

d. Radar navigation assistance (vectors) may be initiated by the controller when one of the following conditions exist:

(1) The controller suggests the vector and the pilot concurs.

(2) A special program has been established and vectoring service has been advertised.

(3) In the controller's judgment the vector is necessary for air safety.

e. Radar navigation assistance (vectors) and other radar derived information may be provided in response to pilot requests. Many factors, such as limitations of radar, volume of traffic, communications frequency, congestion, and controller workload could prevent the controller from providing it. The controller has complete discretion for determining if he is able to provide the service in a particular case. His decision not to provide the service in a particular case is not subject to question.

165. TERMINAL RADAR PROGRAMS FOR VFR AIRCRAFT

a. Basic Radar Service

(1) In addition to the use of radar for the control of IFR aircraft, all commissioned radar facilities provide traffic advisories and limited vectoring (on a workload permitting basis) to VFR aircraft.

NOTE.— When the STAGE services were developed, two basic radar services (traffic advisories and limited vectoring) were identified as STAGE I. This definition became, over the years, unnecessary. Therefore, the term STAGE I has been eliminated from use in the field and the handbooks. These basic services will still be provided by all commissioned terminal radar facilities whether they are STAGE II, III, or neither.

(2) Vectoring service may be provided when requested by the pilot or with pilot concurrence when suggested by ATC.

(3) Pilots of arriving aircraft should contact approach control on the publicized frequency and give their position, altitude, radar beacon code (if transponder equipped), destination, and request traffic information.

(4) Approach control will issue wind and runway, except when the pilot states "HAVE NUMBERS" or this information is contained in the ATIS broadcast and the pilot indicates he has received the ATIS information. Traffic information is provided on a workload permitting basis. Approach control will specify the time or place at which the pilot is to contact the tower on local control frequency for further landing information. Upon being told to contact the tower, radar service is automatically terminated.

b. Stage II Service (Radar Advisory and Sequencing for VFR Aircraft)

(1) This service has been implemented at certain terminal locations (See locations listed in the Airport/Facility Directory). The purpose of the service is to adjust the flow of arriving VFR and IFR aircraft into the traffic pattern in a safe and orderly manner and to provide radar traffic information to departing VFR aircraft. Pilot participation is urged but it is not mandatory.

(2) Pilots of arriving VFR aircraft should initiate radio contact on the publicized frequency with approach control when approximately 25 miles from the airport at which Stage II services are being provided. On initial contact by VFR aircraft, approach control will assume that Stage II service is requested. Approach control will provide the pilot with wind and runway (except when the pilot states "HAVE NUMBERS" or that he has received the ATIS information), routings, etc., as necessary for proper sequencing with other participating VFR and IFR traffic en route to the airport. Traffic information will be provided on a workload permitting basis. If an arriving aircraft does not want the service, the pilot should state "NEGATIVE STAGE II" or make a similar comment, on initial contact with approach control.

(3) After radar contact is established, the pilot may navigate on his own into the traffic pattern or, depending on traffic conditions, may be directed to fly specific headings to position the flight behind a preceding aircraft in the approach sequence. When a flight is positioned behind the preceding aircraft and the pilot reports having that aircraft in sight, he will be directed to follow it. If other "nonparticipating" or "local" aircraft are in the traffic pattern, the tower will issue a landing sequence. Radar service will be continued to the runway.

(4) Standard radar separation will be provided between IFR aircraft until such time as the aircraft is sequenced and the pilot sees the traffic he is to follow. Standard radar separation between VFR or between VFR and IFR aircraft will not be provided.

(5) Pilots of departing VFR aircraft are encouraged to request radar traffic information by notifying ground control on initial contact with their request and proposed direction of flight.

EXAMPLE:

XRAY GROUND CONTROL, NOVEMBER ONE EIGHT SIX, READY TO TAXI, VFR SOUTHBOUND, HAVE INFORMATION BRAVO AND REQUEST RADAR TRAFFIC INFORMATION.

NOTE.— Following takeoff, the tower will advise when to contact departure control.

(6) Pilots of aircraft transiting the area and in radar contact/communication with approach control will receive traffic information on a controller workload permitting basis. Pilots of such aircraft should give their position, altitude, radar beacon code (if transponder equipped), destination, and/or route of flight.

c. Stage III Service (Radar Sequencing and Separation Service for VFR Aircraft).

(1) This service has been implemented at certain terminal locations. The service is advertised in the Airport/Facility Directory. The purpose of this service is to provide separation between all participating VFR aircraft and all IFR aircraft operating within the airspace defined as the Terminal Radar Service Area (TRSA). Pilot participation is urged but it is not mandatory.

(2) If any aircraft does not want the service, the pilot should state "NEGATIVE STAGE III" or make a similar comment, on initial contact with approach control or ground control, as appropriate.

(3) TRSAs are depicted on sectional aeronautical charts. A complete list of TRSA locations is contained in PARA. 166.

(4) While operating within a TRSA, pilots are provided Stage III service and separation as prescribed in this paragraph. In the event of a radar outage, separation and sequencing of VFR aircraft will be suspended as this service is dependent on radar. The pilot will be advised that the service is not available and issued wind, runway information, and the time or place to contact the tower. Traffic information will be provided on a workload permitting basis.

(5) Visual separation is used when prevailing conditions permit and it will be applied as follows:

(a) When a VFR flight is positioned behind the preceding aircraft and the pilot reports having that aircraft in sight, he will be directed to follow it. Radar service will be continued to the runway.

(b) When IFR flights are being sequenced with other traffic and the pilot reports the aircraft he is to follow in sight, the pilot may be directed to follow it and will be cleared for a "visual approach."

(c) If other "nonparticipating" or "local" aircraft are in the traffic pattern, the tower will issue a landing sequence.

(d) Departing VFR aircraft may be asked if they can visually follow a preceding departure out of the TRSA. If the pilot concurs, he will be directed to follow it until leaving the TRSA.

(6) Until visual separation is obtained, standard vertical or radar separation will be provided.

(a) 1000 feet vertical separation may be used between IFR aircraft.

(b) 500 feet vertical separation may be used between VFR aircraft, or between a VFR and an IFR aircraft.

(c) Radar separation varies depending on size of aircraft and aircraft distance from the radar antenna. The minimum separation used will be 1 1/2 miles for most VFR aircraft under 12,500 pounds GWT. If being separated from larger aircraft, the minimum is increased appropriately.

(7) Pilots operating VFR under Stage III in a TRSA—

(a) Must maintain an altitude when assigned by ATC unless the altitude assignment is to maintain at or below a specified altitude. ATC may assign altitudes for separation that do not conform to FAR—91.109. When the altitude assignment is no longer needed for separation or when leaving the TRSA, the instruction will be broadcast, "RESUME APPROPRIATE VFR ALTITUDES." Pilots must then return to an altitude that conforms to FAR—91.109 as soon as practicable.

(b) When not assigned an altitude, the pilot should coordinate with ATC prior to any altitude change.

(8) Within the TRSA, traffic information on observed but unidentified targets will, to the extent possible, be provided all IFR and participating VFR aircraft. At the request of the pilot, he will be vectored to avoid the observed traffic, insofar as possible, provided the aircraft to be vectored is within the airspace under the jurisdiction of the controller.

(9) Departing aircraft should inform ATC of their intended destination and/or route of flight and proposed cruising altitude.

(10) ATC will normally advise participating VFR aircraft when leaving the geographical limits of the TRSA. Radar service is not automatically terminated with this advisory unless specifically stated by the controller.

d. PILOT RESPONSIBILITY: THESE PROGRAMS ARE NOT TO BE INTERPRETED AS RELIEVING PILOTS OF THEIR RESPONSIBILITIES TO SEE AND AVOID OTHER TRAFFIC OPERATING IN BASIC VFR WEATHER CONDITIONS, TO ADJUST THEIR OPERATIONS AND FLIGHT PATH AS NECESSARY TO PRECLUDE SERIOUS WAKE ENCOUNTERS, TO MAINTAIN APPROPRIATE TERRAIN AND OBSTRUCTION CLEARANCE, OR TO REMAIN IN WEATHER CONDITIONS EQUAL TO OR BETTER THAN THE MINIMA REQUIRED BY FAR—91.105. WHENEVER COMPLIANCE WITH AN ASSIGNED ROUTE, HEADING AND/OR ALTITUDE IS LIKELY TO COMPROMISE PILOT RESPONSIBILITY RESPECTING TERRAIN AND OBSTRUCTION CLEARANCE, VORTEX EXPOSURE, AND WEATHER MINIMA, APPROACH CONTROL SHOULD BE SO ADVISED AND A REVISED CLEARANCE OR INSTRUCTION OBTAINED.

166. TERMINAL RADAR SERVICE AREAS (TRSAs)

STATE	CITY
ALABAMA	Birmingham, Huntsville, Mobile, Montgomery
ARIZONA	Phoenix, Tucson
ARKANSAS	Ft. Smith, Little Rock
CALIFORNIA	Castle AFB (Merced), Monterey, Oakland, Palm Springs, Sacramento, San Diego, Santa Ana
COLORADO	Colorado Springs
FLORIDA	Tallahassee
GEORGIA	Augusta, Columbus, Macon, Savannah
HAWAII	Kahului
IDAHO	Boise
ILLINOIS	Champaign, Moline, Peoria, Rockford, Springfield
INDIANA	Evansville, Ft. Wayne, Indianapolis, South Bend
IOWA	Cedar Rapids
KANSAS	Wichita
KENTUCKY	Cincinnati (Covington), Lexington, Louisville
LOUISIANA	Baton Rouge, Lafayette, Lake Charles, Monroe, Shreveport
MAINE	Bangor, Portland
MICHIGAN	Flint, Grand Rapids, Kalamazoo, Lansing, Muskegon, Saginaw
MINNESOTA	Rochester
MISSISSIPPI	Columbus AFB, Gulfport, Jackson
MONTANA	Billings, Great Falls
NEBRASKA	Lincoln
NEVADA	Reno
NEW JERSEY	Atlantic City
NEW MEXICO	Albuquerque
NEW YORK	Binghamton, Buffalo, Elmira, Rochester, Rome,
NORTH CAROLINA	Asheville, Charlotte, Fayetteville, Raleigh-Durham, Wilmington
NORTH DAKOTA	Fargo
OHIO	Akron-Canton, Toledo, Youngstown
OKLAHOMA	Altus
PENNSYLVANIA	Allentown, Erie, Harrisburg, Wilkes-Barre
PUERTO RICO	San Juan
RHODE ISLAND	Providence
SOUTH CAROLINA	Charleston, Columbia, Greer, Shaw AFB (Sumter)
SOUTH DAKOTA	Sioux Falls
TENNESSEE	Bristol, Chattanooga, Knoxville, Memphis, Nashville
TEXAS	Amarillo, Abilene, Beaumont, Del Rio (Laughlin AFB), Longview, Midland
UTAH	Salt Lake City
VERMONT	Burlington
VIRGINIA	Dulles, Roanoke
WASHINGTON	Spokane, Tacoma, NAS Whidbey Island
WEST VIRGINIA	Charleston, Huntington
WISCONSIN	Green Bay, Madison, Milwaukee

A number of facilities with charted TRSAs have found it necessary to temporarily suspend or curtail Stage III service. Pilots should consult NOTAMs for the latest information on services available. Pilots should also be aware that some TRSAs underlie or are adjacent to TCAs.

167. TOWER EN ROUTE CONTROL (TEC)

a. TEC is an ATC program to provide a service to aircraft proceeding to and from metropolitan areas. It links designated approach control areas by a network of identified routes made up of the existing airway structure of the National Airspace System. The FAA initiated an expanded TEC program to include as many facilities as possible. The program's intent is to provide an overflow resource in the low altitude system which would enhance ATC services. A few facilities have historically allowed turbojets to proceed between certain city pairs, such as Milwaukee and Chicago, via tower en route and these locations may continue this service. However, the expanded TEC program will be applied, generally, for nonturbojet aircraft operating at and below 10,000 feet. The program is entirely within the approach control airspace of multiple terminal facilities. Essentially, it is for relatively short flights. Participating pilots are encouraged to use TEC for flights of two hours duration or less. If longer flights are planned, extensive coordination may be required within the multiple complex which could result in unanticipated delays.

b. Pilots requesting TEC are subject to the same delay factor at the destination airport as other aircraft in the ATC system. In addition, departure and en route delays may occur depending upon individual facility workload. When a major metropolitan airport is incurring significant delays, pilots in the TEC program may want to consider an alternative airport experiencing no delay.

c. There are no unique requirements upon pilots to use the TEC program. Normal flight plan filing procedures will ensure proper flight plan processing. Pilots should include the acronym "TEC" in the remarks section of the flight plan when requesting tower en route. Pictorial and specific route descriptions are published in the Airport/Facility Directory (A/FD).

d. All approach controls in the system may not operate up to the maximum TEC altitude of 10,000 feet. The highest altitude available between any city pair is identified in the A/FD and may be revised in subsequent editions. Additionally, not all airports within an approach control's area are listed. IFR flight may be planned to any satellite airport in proximity to the major primary airport via the same routing (see A/FD for details).

168—169. RESERVED

170. TRANSPONDER OPERATION

a. GENERAL

(1) Pilots should be aware that proper application of transponder operating procedures will provide both VFR and IFR aircraft with a higher degree of safety in the environment where high-speed closure rates are possible. Transponders substantially increase the capability of radar to see an aircraft and the MODE C feature enables the controller to quickly determine where potential traffic conflicts may exist. Even VFR pilots who are not in contact with ATC will be afforded greater protection from IFR aircraft and VFR aircraft which are receiving traffic advisories. Nevertheless, pilots should never relax their visual scanning vigilance for other aircraft.

(2) Air Traffic Control Radar Beacon System (ATCRBS) is similar to and compatible with military coded radar beacon equipment. Civil MODE A is identical to military MODE 3.

(3) Civil and military transponders should be adjusted to the "on" or normal operating position as late as practicable prior to takeoff and to "off" or "standby" as soon as practicable after completing landing roll unless the change to "standby" has been accomplished previously at the request of ATC. IN ALL CASES, WHETHER VFR OR IFR, THE TRANSPONDER SHOULD BE OPERATING WHILE AIRBORNE UNLESS OTHERWISE REQUESTED BY ATC.

(4) If a pilot on an IFR flight cancels his IFR flight plan prior to reaching his destination, he should adjust his transponder according to VFR operations.

(5) If entering a U.S. domestic control area from outside the U.S., the pilot should advise on first radio contact with a U.S. radar ATC facility that such equipment is available by adding "transponder" to the aircraft identification.

(6) It should be noted by all users of the ATC Transponders that the coverage they can expect is limited to "line of sight." Low altitude or aircraft antenna shielding by the aircraft itself may result in reduced range. Range can be improved by climbing to a higher altitude. It may be possible to minimize antenna shielding by locating the antenna where dead spots are only noticed during abnormal flight attitudes.

b. TRANSPONDER CODE DESIGNATION

(1) For ATC to utilize one or a combination of the 4096 discrete codes FOUR DIGIT CODE DESIGNATION will be used, e.g., code 2100 will be expressed as TWO ONE ZERO ZERO. Due to the operational characteristics of the rapidly expanding automated air traffic control system, THE LAST TWO DIGITS OF THE SELECTED TRANSPONDER CODE SHOULD ALWAYS READ "00" UNLESS SPECIFICALLY REQUESTED BY ATC TO BE OTHERWISE.

c. AUTOMATIC ALTITUDE REPORTING (MODE C)

(1) Some transponders are equipped with a MODE C automatic altitude reporting capability. This system converts aircraft altitude in 100 foot increments to coded digital information which is transmitted together with MODE C framing pulses to the interrogating radar facility. The manner in which transponder panels are designed differs, therefore, a pilot should be thoroughly familiar with the operation of his transponder so that ATC may realize its full capabilities.

(2) Adjust transponder to reply on the MODE A/3 code specified by ATC and, if equipped, to reply on MODE C with altitude reporting *capability activated* unless deactivation is directed by ATC or unless the installed aircraft equipment has not been tested and calibrated as required by FAR—91.36. If deactivation is required by ATC, turn off the altitude reporting feature of your transponder. An instruction by ATC to "STOP ALTITUDE SQUAWK, ALTITUDE DIFFERS (number of feet) FEET," may be an indication that your transponder is transmitting incorrect altitude information or that you have an incorrect altimeter setting. While an incorrect altimeter setting has no effect on the MODE C altitude information transmitted by your transponder (transponders are preset at 29.92), it would cause you to fly at an actual altitude different from your assigned altitude. When a controller indicates that an altitude readout is invalid, the pilot should initiate a check to verify that the aircraft altimeter is set correctly.

(3) Pilots of aircraft with operating MODE C altitude reporting transponders should report exact altitude or flight level to the nearest hundred foot increment when establishing initial contact with an ATC facility. Exact altitude or flight level reports on initial contact provide ATC with information that is required prior to using MODE C altitude information for separation purposes. This will significantly reduce altitude verification requests.

d. TRANSPONDER IDENT FEATURE

(1) The transponder shall be operated only as specified by ATC. Activate the "IDENT" feature only upon request of the ATC controller.

e. CODE CHANGES

(1) When making routine code changes, pilots should avoid inadvertent selection of codes 7500, 7600 or 7700 thereby causing momentary false alarms at automated ground facilities. For example when switching from code 2700 to code 7200, switch first to 2200 then to 7200, NOT to 7700 and then 7200. This procedure applies to nondiscrete code 7500 and all discrete codes in the 7600 and 7700 series (i.e. 7600-7677, 7700-7777) which will trigger special indicators in automated facilities. Only nondiscrete code 7500 will be decoded as the hijack code.

(2) Under no circumstances should a pilot of a civil aircraft operate the transponder on Code 0001. This code is reserved for military interceptor operations.

(3) Military pilots operating VFR or IFR within restricted/warning areas should adjust their transponders to code 4000 unless another code has been assigned by ATC.

f. DEVIATIONS FROM TRANSPONDER REQUIREMENTS

(1) Specific details concerning requirements, exceptions and ATC authorized deviations for transponder and MODE C operation above 12,500 feet and below 18,000 feet MSL are found in FAR—91.24. In general, the FAR requires aircraft to be equipped with MODE A/3 (4096 codes) and MODE C altitude reporting capability when operating in controlled airspace of the 48 contiguous States and the District of Columbia above 12,500 feet MSL, excluding airspace at and below 2,500 feet AGL. Pilots should insure that their aircraft transponder is operating on an appropriate or ATC assigned VFR/IFR code and MODE C when operating in such airspace. If in doubt about the operational status of either feature of your transponder while airborne, contact the nearest ATC facility or FSS and they will advise you what facility you should contact for determining the status of your equipment. In-flight requests for "immediate" deviation may be approved by controllers only when the flight will continue IFR or when weather conditions prevent VFR descent and continued VFR flight in airspace not affected by the FAR. All other requests for deviation should be made by contacting the nearest Flight Service or Air Traffic facility in person or by telephone. The nearest ARTCC will normally be the controlling agency and is responsible for coordinating requests involving deviations in other ARTCC areas.

g. TRANSPONDER OPERATION UNDER VISUAL FLIGHT RULES (VFR)

(1) Unless otherwise instructed by an Air Traffic Control Facility, adjust Transponder to reply on MODE 3/A code 1200 regardless of altitude.

(2) Adjust transponder to reply on MODE C, with altitude reporting *capability activated* if the aircraft is so equipped, unless deactivation is directed by ATC or unless the installed equipment has not been tested and calibrated as required by FAR—91.36. If deactivation is required and your transponder is so designed, turn off the altitude reporting switch and continue to transmit MODE C framing pulses. If this capability does not exist, turn off MODE C.

h. RADAR BEACON PHRASEOLOGY

Air traffic controllers, both civil and military, will use the following phraseology when referring to operation of the Air Traffic Control Radar Beacon System (ATCRBS). Instructions by ATC refer only to MODE A/3 or MODE C operation and do not affect the operation of the transponder on other MODEs.

(1) **SQUAWK (number)** — Operate radar beacon transponder on designated code in MODE A/3.

(2) **IDENT** — Engage the "IDENT" feature (military I/P) of the transponder.

(3) **SQUAWK (number) and IDENT** — Operate transponder on specified code in MODE A/3 and engage the "IDENT" (military I/P) feature.

(4) **SQUAWK STANDBY** — Switch transponder to standby position.

(5) **SQUAWK LOW/NORMAL** — Operate transponder on low or normal sensitivity as specified. Transponder is operated in "NORMAL" position unless ATC specifies "LOW", ("ON" is used instead of "NORMAL" as a master control label on some types of transponders.)

(6) **SQUAWK ALTITUDE** — Activate MODE C with automatic altitude reporting.

(7) **STOP ALTITUDE SQUAWK** — Turn off altitude reporting switch and continue transmitting MODE C framing pulses. If your equipment does not have this capability, turn off MODE C.

(8) **STOP SQUAWK (mode in use)** — Switch off specified mode. (Used for military aircraft when the controller is unaware of military service requirements for the aircraft to continue operation on another MODE.)

(9) **STOP SQUAWK** — Switch off transponder.

(10) **SQUAWK MAYDAY** — Operate transponder in the emergency position (MODE A Code 7700 for civil transponder. MODE 3 Code 7700 and emergency feature for military transponder.)

171. HAZARDOUS AREA REPORTING SERVICE

a. Selected FSSs provide flight monitoring where regularly traveled VFR routes cross large bodies of water, swamps, and mountains. This service is provided for the purpose of expeditiously alerting Search and Rescue facilities when required.

(1) When requesting the service either in person, by telephone or by radio, pilots should be prepared to give the following information — type of aircraft, altitude, indicated airspeed, present position, route of flight, heading.

(2) Radio contacts are desired at least every 10 minutes. If contact is lost for more than 15 minutes, Search and Rescue will be alerted. Pilots are responsible for cancelling their request for service when they are outside the service area boundary. Pilots experiencing two-way radio failure are expected to land as soon as practicable and cancel their request for the service. The accompanying illustration titled "LAKE, ISLAND, MOUNTAIN AND SWAMP REPORTING SERVICE" depicts the areas and the FSS facilities involved in this program.

b. LONG ISLAND SOUND REPORTING SERVICE

The New York and Bridgeport FSSs provide Long Island Sound Reporting service on request for aircraft traversing Long Island Sound.

(1) When requesting the service pilots should ask for SOUND REPORTING SERVICE and should be prepared to provide the following appropriate information:

(a) Type and color of aircraft,

(b) The specific route and altitude across the sound including the shore crossing point,

(c) The overwater crossing time,

(d) Number of persons on board,

(e) True air speed.

(2) Radio contacts are desired at least every 10 minutes, however, for flights of shorter duration a midsound report is requested. If contact is lost for more than 15 minutes Search and Rescue will be alerted. Pilots are responsible for cancelling their request for the Long Island Sound Reporting Service when outside the service area boundary. Aircraft experiencing radio failure will be expected to land as soon as practicable and cancel their request for the service.

(3) COMMUNICATIONS: Primary communications—pilots are to transmit on 122.1 MHz and listen on one of the following VOR frequencies:

(a) NEW YORK FSS CONTROLS:

1. Hampton VORTAC (FSS transmits on 113.6 and receives on 122.1 MHz).

2. Calverton VORTAC (FSS transmits on 117.2 and receives on standard FSS frequencies).

3. Kennedy VORTAC (FSS transmits on 115.9 and receives on 122.1 MHz).

(b) BRIDGEPORT FSS CONTROLS:

1. Madison VORTAC (FSS transmits on 110.4 and receives on 122.1 MHz).

2. Trumbull VOR (FSS transmits on 111.8 and receives on 122.1 MHz).

3. Bridgeport VOR (FSS transmits on 108.8 and receives on 122.1 MHz).

c. BLOCK ISLAND REPORTING SERVICE

Within the Long Island Reporting Service, the New York FSS also provides an additional service for aircraft operating between Montauk Point and Block Island. When requesting this service, pilots should ask for BLOCK ISLAND REPORTING SERVICE and should be prepared to provide the same flight information as required for the Long Island Sound Reporting Service.

(1) A minimum of three position reports are mandatory for this service; these are:

(a) Reporting leaving either Montauk Point or Block Island.

(b) Midway report.

(c) Report when over either Montauk Point or Block Island. At this time, the overwater service is cancelled.

(2) COMMUNICATIONS: Pilots are to transmit on 122.1 MHz and listen on the Hampton VORTAC (HTO) frequency 113.6 MHz.

NOTE.— Pilots are advised that 122.1 MHz is a remote receiver located at the Hampton VORTAC site and designed to provide radio coverage between Hampton and Block Island. Flights proceeding beyond Block Island may contact the Boston FSS on 122.6 MHz (transmit and receive) or by transmitting on 122.1 MHz and listening on Martha's Vineyard VORTAC (MVY) frequency 108.2 MHz.

d. CAPE COD AND ISLANDS RADAR OVERWATER FLIGHT FOLLOWING

In addition to normal VFR radar advisory services, traffic permitting, Otis Approach Control provides a radar overwater flight following service for aircraft traversing the Cape Cod and adjacent Island area. Pilots desiring this service may contact Otis RAPCON on 118.2 MHz.

(1) Pilots requesting this service should be prepared to give the following information:

(a) type and color of aircraft,

(b) altitude,

(c) position and heading,

(d) route of flight, and

(e) true airspeed.

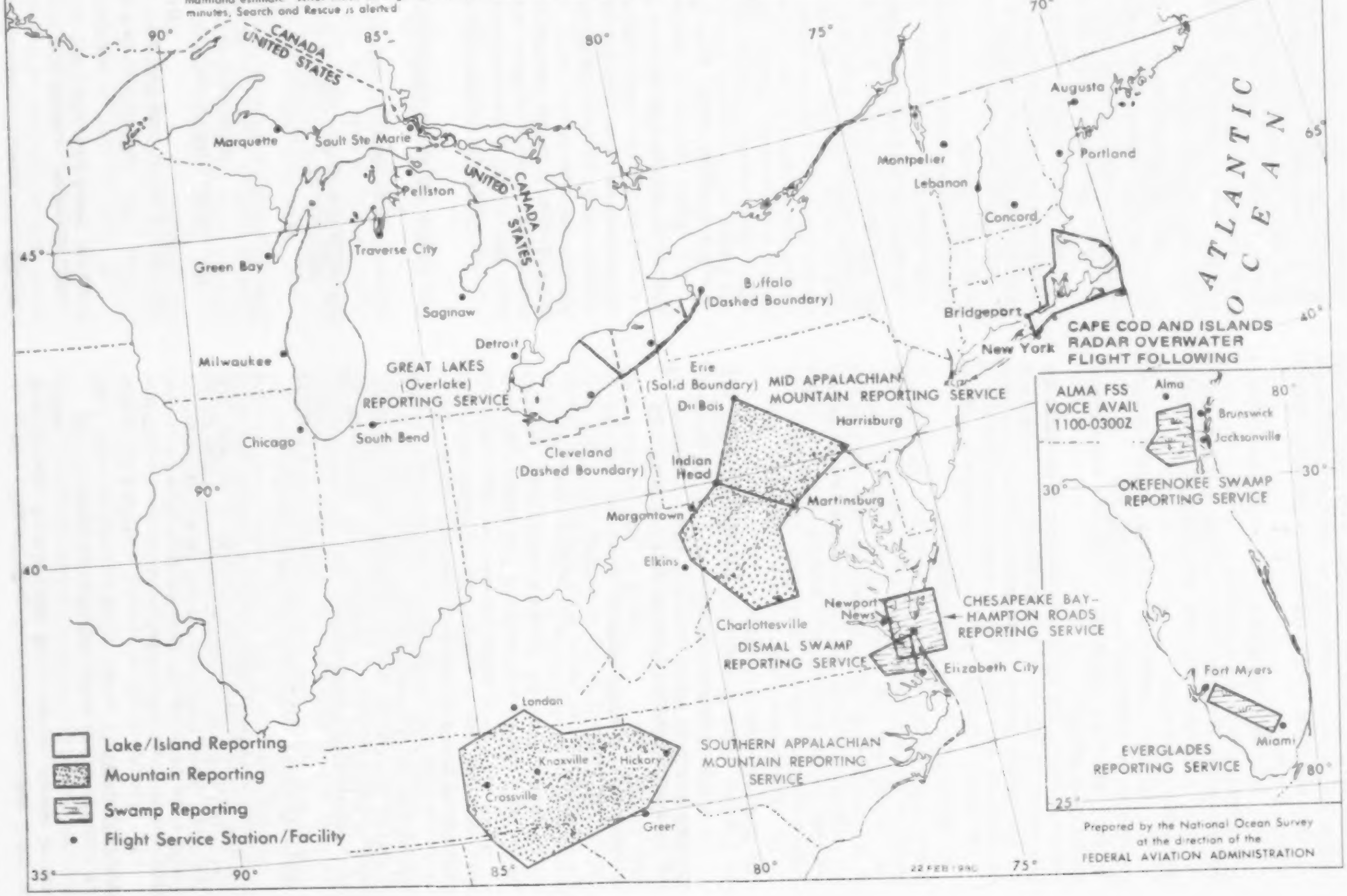
(2) For best radar coverage, pilots are encouraged to fly at 1,500 feet MSL or above.

(3) Pilots are responsible for cancelling their request for overwater flight following when they are over the mainland and/or outside the service area boundary.

172—189. RESERVED

LAKE/ISLAND, MOUNTAIN AND SWAMP REPORTING SERVICE
Flight Service Station (FSS)

This service provides flight monitoring where regularly traveled VFR routes cross large bodies of water, swamps, and mountains, for the purpose of expeditiously alerting Search and Rescue facilities when required. Areas covered, associated Flight Service Stations, and the name of the service, "Stoneface", "Overlake" etc., are indicated on the following charts. To obtain this service, contact the FSS by telephone or radio giving present position, type aircraft, altitude, indicated air speed, proposed route of flight, and mainland estimate. After these arrangements have been made, a radio contact with the FSS is required every ten minutes while enroute. If contact is lost for more than fifteen minutes, Search and Rescue is alerted.


CANADA
UNITED STATES
Marquette
Sault Ste Marie
Pellston
Traverse City
Green Bay
Saginaw
Milwaukee
Detroit
Chicago
South Bend
GREAT LAKES (Overlake) REPORTING SERVICE
Cleveland (Dashed Boundary)
Erie (Solid Boundary)
Buffalo (Dashed Boundary)
Du Bois
Indian Head
Morgantown
Elkins
Harrisburg
Martinsburg
MID APPALACHIAN MOUNTAIN REPORTING SERVICE
Charlottesville
Newport News
DISMAL SWAMP REPORTING SERVICE
CHESAPEAKE BAY-HAMPTON ROADS REPORTING SERVICE
Elizabeth City
London
Knoxville
Hickory
Crossville
Greer
SOUTHERN APPALACHIAN MOUNTAIN REPORTING SERVICE
Montpelier
Lebanon
Concord
Augusta
Portland
Bridgeport
New York
CAPE COD AND ISLANDS RADAR OVERWATER FLIGHT FOLLOWING
ATLANTIC OCEAN
ALMA FSS VOICE AVAIL 1100-0300Z
Alma
Brunswick
Jacksonville
OKEFENOKEE SWAMP REPORTING SERVICE
Fort Myers
Miami
EVERGLADES REPORTING SERVICE
90°
85°
80°
75°
70°
65°
45°
40°
35°
30°
25°
22 FEB 1990
Lake/Island Reporting
Mountain Reporting
Swamp Reporting
Flight Service Station/Facility

Prepared by the National Ocean Survey
at the direction of the
FEDERAL AVIATION ADMINISTRATION

Section 2. RADIO COMMUNICATIONS PHRASEOLOGY AND TECHNIQUES

190. GENERAL

a. Radio communications are a critical link in the ATC system. The link can be a strong bond between pilot and controller or it can be broken with surprising speed and disastrous results. Discussion herein provides basic procedures for new pilots and also highlights safe operating concepts for all pilots.

b. The single, most important thought in pilot-controller communications is understanding. It is essential, therefore, that pilots acknowledge each radio communication with ATC by using the appropriate aircraft call sign. Brevity is important, and contacts should be kept as brief as possible, but the controller must know what you want to do before he can properly carry out his control duties. And you, the pilot, must know exactly what he wants you to do. Since concise phraseology may not always be adequate, use whatever words are necessary to get your message across.

c. All pilots will find the Pilot/Controller Glossary very helpful in learning what certain words or phrases mean. Good phraseology enhances safety and is the mark of a professional pilot. Jargon, chatter and "CB" slang have no place in ATC communications. The Pilot/Controller Glossary is the same glossary used in the ATC controller's handbook. We recommend that it be studied and reviewed from time to time to sharpen your communication skills.

d. Calls to air traffic control (ATC) facilities (ARTCCs, Towers, FSSs, Central Flow, and Communications Control Centers) over radio and ATC operational telephone lines (lines used for operational purposes such as controller instructions, briefings, opening and closing flight plans, issuance of IFR clearances and amendments, counter hijacking activities, etc.) may be monitored and recorded for operational uses such as accident investigations, accident prevention, search and rescue purposes, specialist training and evaluation, and technical evaluation and repair of control and communications systems.

191. RADIO TECHNIQUE

a. *Listen* before you transmit. Many times you can get the information you want through ATIS or by monitoring the frequency. Except for a few situations where some frequency overlap occurs, if you hear someone else talking, the keying of your transmitter will be futile and you will probably jam their receivers causing them to repeat their call. If you have just changed frequencies, pause, listen and make sure the frequency is clear.

b. *Think* before keying your transmitter. Know what you want to say and if it is lengthy, e.g., a flight plan or IFR position report, jot it down.

c. The microphone should be very close to your lips and after pressing the mike button, a slight pause may be necessary to be sure the first word is transmitted. Speak in a normal conversational tone.

d. When you release the button, wait a few seconds before calling again. The controller or FSS specialist may be jotting down your number, looking for your flight plan, transmitting on a different frequency, or selecting his transmitter to your frequency.

e. Be alert to the sounds *or lack of sounds* in your receiver. Check your volume, recheck your frequency and *make sure that your microphone is not stuck* in the transmit position. Frequency blockage can, and has, occurred for extended periods of time due to unintentional transmitter operation. This type of interference is commonly referred to as a "stuck mike," and controllers may refer to it in this manner when attempting to assign an alternate frequency. If the assigned frequency is completely blocked by this type of interference, use the procedures described for en route IFR radio frequency outage, to establish or reestablish communications with ATC.

f. Be sure that you are within the performance range of your radio equipment and the ground station equipment. Remote radio sites do not always transmit and receive on all of a facilities available frequencies, particularly with regard to VOR sites where you can hear but not reach a ground station's receiver. Remember that higher altitude increases the range of VHF "line of sight" communications.

192. CONTACT PROCEDURES

a. Initial Contact.

(1) The term initial contact or initial callup means the first radio call you make to a given facility, or the first call to a different controller or FSS specialist within a facility. *Use the following format:*

(a) name of facility being called,

(b) your *full* aircraft identification as filed in the flight plan or as discussed under Aircraft Call Signs below,

(c) type of message to follow or your request if it is short, and

(d) the word "Over", if required.

EXAMPLE:

"NEW YORK RADIO, MOONEY THREE ONE ONE ECHO."

EXAMPLE:

"COLUMBIA GROUND, CESSNA THREE ONE SIX ZERO FOXTROT, IFR MEMPHIS."

EXAMPLE:

"MIAMI CENTER BARON FIVE SIX THREE HOTEL, REQUEST VFR TRAFFIC ADVISORIES."

(2) If radio reception is reasonably assured, inclusion of your request, your position or altitude, the phrase "Have numbers" or "Information Charlie received" (for ATIS) in the initial contact helps decrease radio frequency congestion. Use discretion and do not overload the controller with information he does not need. If you do not get a response from the ground station, recheck your radios or use another transmitter but keep the next contact short.

EXAMPLE:

"ATLANTA CENTER, DUKE FOUR ONE ROMEO, REQUEST VFR TRAFFIC ADVISORIES, TWENTY NORTHWEST ROME, SEVEN THOUSAND FIVE HUNDRED, OVER."

b. Initial Contact When your Transmitting and Receiving Frequencies are Different.

(1) If you are attempting to establish contact with a ground station and you are receiving on a different frequency than that transmitted, indicate the VOR name or the frequency on which you expect a reply. Most FSSs and control facilities can transmit on several VOR stations in the area. Use the appropriate FSS call sign as indicated on charts.

EXAMPLE:

New York FSS transmits on the Kennedy, Hampton and Calverton VORTACs. If you are in the Calverton area, your callup should be "NEW YORK RADIO, CESSNA THREE ONE SIX ZERO FOXTROT, RECEIVING CALVERTON VOR, OVER."

(2) If the chart indicates FSS frequencies above the VORTAC or in FSS communications boxes, transmit or receive on those frequencies nearest your location.

(3) When unable to establish contact and you wish to call *any* ground station, use the phrase "ANY RADIO (tower) (station), GIVE CESSNA THREE ONE SIX ZERO FOXTROT A CALL ON (frequency) OR (VOR)." If an emergency exists or you need assistance, so state.

c. Subsequent Contacts and Responses to Callup from a Ground Facility.

Use the same format as used for initial contact except you should state your message or request with the callup in one transmission. The ground station name and the word "Over" may be omitted if the message requires an obvious reply and there is no possibility for misunderstandings. *You should acknowledge all callups or clearances* unless the controller or FSS specialist advises otherwise. There are some occasions when the controller must issue time-critical instructions to other aircraft and he may be in a position to observe your response, either visually or on radar. If the situation demands your response, take appropriate action or immediately advise the facility of any problem. Acknowledgement is made with one of the words "Wilco, Roger, Affirmative, Negative" or other appropriate remarks (e.g., "PIPER TWO ONE FOUR LIMA, ROGER"). If you have been receiving services (e.g., VFR traffic advisories and you are leaving the area or changing frequencies), advise the ATC facility and terminate contact.

d. Acknowledgement of Frequency Changes.

(1) When advised by ATC to change frequencies, acknowledge the instruction. If you select the new frequency without an acknowledgement, the controller's workload is increased because he has no way of knowing whether you received the instruction or have had radio communications failure.

(2) At times, a controller/specialist may be working a sector with multiple frequency assignments. In order to eliminate unnecessary verbiage and to free the controller/specialist for higher priority transmissions, the controller/specialist may request the pilot "(Identification), change to my frequency 123.4." This phrase should alert the pilot that he is only changing frequencies, not controller/specialist, and that initial call up phraseology may be abbreviated.

EXAMPLE:

"UNITED 222 ON 123.4."

e. Compliance with Frequency Changes.

When instructed by ATC to change frequencies, select the new frequency as soon as possible unless instructed to make the change at a specific time, fix, or altitude. A delay in making the change could result in an untimely receipt of important information. If you are instructed to make the frequency change at a specific time, fix, or altitude, monitor the frequency you are on until reaching the specified time, fix, or altitudes unless instructed otherwise by ATC. (See PARA—340 - ARTCC COMMUNICATIONS.)

193. AIRCRAFT CALL SIGNS

a. Precautions in the Use of Call Signs.

(1) Improper use of call signs can result in pilots executing a clearance intended for another aircraft. Call signs should *never be abbreviated on an initial contact or at any time when other aircraft call signs have similar numbers/sounds or identical letters/number* (e.g., Cessna 6132F, Cessna 1622F, Baron 123F, Cherokee 7732F, etc.).

EXAMPLE:

Assume that a controller issues an approach clearance to an aircraft at the bottom of a holding stack and an aircraft with a similar call sign (at the top of the stack) acknowledges the clearance with the last two or three numbers of his call sign. If the aircraft at the bottom of the stack did not hear the clearance and intervene, flight safety would be affected, and there would be no reason for either the controller or pilot to suspect that anything is wrong. This kind of "human factors" error can strike swiftly and is extremely difficult to rectify.

(2) Pilots; therefore, must be certain that aircraft identification is complete and clearly identified before taking action on an ATC clearance. ATC specialists will not abbreviate call signs of air carrier or other civil aircraft having authorized call signs. ATC specialists may initiate abbreviated call signs of other aircraft by using the *prefix and the last three digits/letters* of the aircraft identification after communications are established. The pilot may use the abbreviated call sign in subsequent contacts with the ATC specialist. When aware of similar/identical call signs, ATC specialists will take action to minimize errors by emphasizing certain numbers/letters, by repeating the entire call sign, repeating the prefix, or by asking pilots to use a different call sign temporarily. Pilots should use the phrase "VERIFY CLEARANCE FOR (your complete call sign)" if doubt exists concerning proper identity.

(3) Civil aircraft pilots should state the aircraft type, model or manufacturer's name followed by the digits/letters of the registration number. When the aircraft manufacturer's name or model is stated, the prefix "N" is dropped (e.g. Aztec Two Four Six Four Alpha).

EXAMPLE:

BONANZA SIX FIVE FIVE GOLF.

EXAMPLE:

BREEZY SIX ONE THREE ROMEO EXPERIMENTAL (omit "Experimental" after initial contact).

(4) Air Taxi or other commercial operators *not* having FAA authorized call signs should prefix their normal identification with the phonetic word "Tango".

EXAMPLE:

TANGO AZTEC TWO FOUR SIX FOUR ALPHA.

(5) Air carriers and commuter air carriers having FAA authorized call signs should identify themselves by stating the complete call sign, using group form for the numbers and the word "heavy" if appropriate.

EXAMPLE:

UNITED TWENTY-FIVE HEAVY.

EXAMPLE:

MIDWEST COMMUTER SEVEN ELEVEN.

(6) Military aircraft use a variety of systems including serial numbers, word call signs and combinations of letters/numbers. Examples include Army Copter 48931, Air Force 61782, MAC 31792, Pat 157, Air Evac 17652, Navy Golf Alfa Kilo 21, Marine 4 Charlie 36, etc.

b. Air Ambulance Flights.

(1) Civilian air ambulance flights responding to medical emergencies (carrying patients, organ donors, organs, or other urgently needed lifesaving medical material) will be expedited by ATC when necessary. When expeditious handling is required, add the word "LIFEGUARD" in the remarks of the flight plan. In radio communication, use the call sign "LIFEGUARD" followed by the aircraft type and registration letters/numbers. When requested by the pilot, necessary notification to expedite ground handling of patients, etc., is provided by ATC; however, when possible, this information should be passed in advance through non-ATC communications systems. Extreme discretion is necessary in using the term "LIFEGUARD." It is intended only for those missions of an urgent medical nature and for use only for that portion of the flight requiring expedited handling.

(2) Similar provisions have been made for the use of "AIR EVAC" and "MED EVAC" by military air ambulance flights, except that these military flights will receive priority handling only when specifically requested.

EXAMPLE:

LIFEGUARD CESSNA TWO SIX FOUR SIX.

c. Student Pilots Radio Identification.

(1) The FAA desires to help the student pilot in acquiring sufficient practical experience in the environment in which he will be required to operate. To receive additional assistance while operating in areas of concentrated air traffic, a student pilot need only identify himself as a student pilot during his initial call to an FAA radio facility.

EXAMPLE:

DAYTON TOWER, THIS IS FLEETWING 1234, STUDENT PILOT.

(2) This special identification will alert FAA ATC personnel and enable them to provide the student pilot with such extra assistance and consideration as he may need. This procedure is not mandatory.

194. DESCRIPTION OF INTERCHANGE OR LEASED AIRCRAFT

a. Controllers issue traffic information based on familiarity with airline equipment and color/markings. When an air carrier dispatches a flight using another company's equipment and the pilot does not advise the terminal ATC facility, the possible confusion in aircraft identification can compromise safety.

b. Pilots flying an "interchange" or "leased" aircraft not bearing the colors/markings of the company operating the aircraft should inform the terminal ATC facility on first contact the name of the operating company and trip number, followed by the company name as displayed on the aircraft, and aircraft type.

EXAMPLE:

AIR CAL 311, UNITED (INTERCHANGE/LEASE), BOEING 727.

195. GROUND STATION CALL SIGNS

Pilots, when calling a ground station, should begin with the name of the facility being called followed by the type of the facility being called, as indicated in the following examples.

Airport Unicom	"Shannon Unicom"
FAA Flight Service Station	"Chicago Radio"
FAA Flight Service Station (En Route Flight Advisory Service (Weather)	"Seattle Flight Watch"
Airport Traffic Control Tower	"Augusta Tower"
Clearance Delivery Position (IFR)	"Dallas Clearance Delivery"
Ground Control Position in Tower	"Miami Ground"
Radar or Nonradar Approach Control Position	"Oklahoma City Approach"
Radar Departure Control Position	"St. Louis Departure"
FAA Air Route Traffic Control Center	"Washington Center"

196. PHONETIC ALPHABET

The International Civil Aviation Organization (ICAO) phonetic alphabet is used by FAA personnel when communications conditions are such that the information cannot be readily received without their use. ATC facilities may also request pilots to use phonetic letter equivalents when aircraft with similar sounding identifications are receiving communications on the same frequency. Pilots should use the phonetic alphabet when identifying their aircraft during initial contact with air traffic control facilities. Additionally use the phonetic equivalents for single letters and to spell out groups of letters or difficult words during adverse communications conditions.

CHARACTER	MORSE CODE	TELEPHONY	PHONIC (PRONUNCIATION)
A	○▭	Alfa	(AL-FAH)
B	▭○○○	Bravo	(BRAH-VOH)
C	▭○▭○	Charlie	(CHAR-LEE) or (SHAR-LEE)
D	▭○○	Delta	(DELL-TAH)
E	○	Echo	(ECK-OH)
F	○○▭○	Foxtrot	(FOKS-TROT)
G	▭▭○	Golf	(GOLF)
H	○○○○	Hotel	(HOH-TEL)
I	○○	India	(IN-DEE-AH)
J	○▭▭▭	Juliett	(JEW-LEE-ETT)
K	▭○▭	Kilo	(KEY-LOH)
L	○▭○○	Lima	(LEE-MAH)
M	▭▭	Mike	(MIKE)
N	▭○	November	(NO-VEM-BER)
O	▭▭▭	Oscar	(OSS-CAH)
P	○▭▭○	Papa	(PAH-PAH)
Q	▭▭○▭	Quebec	(KEH-BECK)
R	○▭○	Romeo	(ROW-ME-OH)
S	○○○	Sierra	(SEE-AIR-RAH)
T	▭	Tango	(TANG-GO)
U	○○▭	Uniform	(YOU-NEE-FORM) or (OO-NEE-FORM)
V	○○○▭	Victor	(VIK-TAH)
W	○▭▭	Whiskey	(WISS-KEY)
X	▭○○▭	Xray	(ECKS-RAY)
Y	▭○▭▭	Yankee	(YANG-KEY)
Z	▭▭○○	Zulu	(ZOO-LOO)
1	○▭▭▭▭	One	(WUN)
2	○○▭▭▭	Two	(TOO)
3	○○○▭▭	Three	(TREE)
4	○○○○▭	Four	(FOW-ER)
5	○○○○○	Five	(FIFE)
6	▭○○○○	Six	(SIX)
7	▭▭○○○	Seven	(SEV-EN)
8	▭▭▭○○	Eight	(AIT)
9	▭▭▭▭○	Nine	(NIN-ER)
0	▭▭▭▭▭	Zero	(ZEE-RO)

197—199. RESERVED

200. FIGURES

a. Figures indicating hundred and thousands in round number, as for ceiling heights, and upper wind levels up to 9900 shall be spoken in accordance with the following:

EXAMPLE:

500..FIVE HUNDRED

EXAMPLE:

4500.................FOUR THOUSAND FIVE HUNDRED

b. Numbers above 9900 shall be spoken by separating the digits preceding the word "thousand."

EXAMPLE:

10,000....................................ONE ZERO THOUSAND

EXAMPLE:

13,500...ONE THREE THOUSAND FIVE HUNDRED

c. Transmit airway or jet route numbers as follows:

EXAMPLE:

V12.. VICTOR TWELVE

EXAMPLE:

J533...J FIVE THIRTY-THREE

d. All other numbers shall be transmitted by pronouncing each digit.

EXAMPLE:

10..ONE ZERO

e. When a radio frequency contains a decimal point, the decimal point is spoken as "POINT."

EXAMPLE:

122.1...............................ONE TWO TWO POINT ONE

NOTE.— ICAO Procedures require the decimal point be spoken as "DECIMAL" and FAA will honor such usage by military aircraft and all other aircraft required to use ICAO Procedures.

201. ALTITUDES AND FLIGHT LEVELS

a. Up to but not including 18,000 feet MSL — state the separate digits of the thousands, plus the hundreds, if appropriate.

EXAMPLE:

12,000.. ONE TWO THOUSAND

EXAMPLE:

12,500.......ONE TWO THOUSAND FIVE HUNDRED

b. At and above, 18,000 feet MSL (FL 180) state the words "flight level" followed by the separate digits of the flight level.

EXAMPLE:

190........................FLIGHT LEVEL ONE NINER ZERO

202. DIRECTIONS

The three digits of bearing, course, heading or wind direction should always be magnetic. The word "true" must be added when it applies.

EXAMPLE:

(magnetic course) 005........................ZERO ZERO FIVE

EXAMPLE:

(true course) 050...................ZERO FIVE ZERO TRUE

EXAMPLE:

(magnetic bearing) 360.....................THREE SIX ZERO

EXAMPLE:

(magnetic heading) 100.....................ONE ZERO ZERO

EXAMPLE:

(wind direction) 220............................TWO TWO ZERO

203. SPEEDS

The separate digits of the speed followed by the word "KNOTS." Except, controllers may omit the word "KNOTS" when using speed adjustment procedures, e.g., "REDUCE/INCREASE SPEED TO TWO FIVE ZERO."

EXAMPLES:

(speed) 250............................TWO FIVE ZERO KNOTS

(speed) 190.........................ONE NINER ZERO KNOTS

The separate digits of the mach number preceded by "MACH."

EXAMPLES:

(mach number) 1.5.............MACH ONE POINT FIVE

(mach number) .64..............MACH POINT SIX FOUR

(mach number) .7......................MACH POINT SEVEN

204. TIME

a. FAA uses Coordinated Universal Time (UTC or Z) for all operations.

b. To Convert from Standard Time to Coordinated Universal Time:

Eastern Standard Time	Add 5 hours
Central Standard Time	Add 6 hours
Mountain Standard Time	Add 7 hours
Pacific Standard Time	Add 8 hours

NOTE.— For Daylight Time subtract 1 hour.

c. The 24-hour clock system is used in radiotelephone transmissions. The hour is indicated by the first two figures and the minutes by the last two figures.

EXAMPLE:

0000..ZERO ZERO ZERO ZERO

EXAMPLE:

0920..ZERO NINER TWO ZERO

d. Time may be stated in minutes only (two figures) in radio telephone communications when no misunderstanding is likely to occur.

e. Current time in use at a station is stated in the nearest quarter minute in order that pilots may use this information for time checks. Fractions of a quarter minute less than eight seconds are stated as the preceding quarter minute; fractions of a quarter minute of eight seconds or more are stated as the succeeding quarter minute.

EXAMPLE:

0929:05...................TIME, ZERO NINER TWO NINER

EXAMPLE:

0929:10...TIME, ZERO NINER TWO NINER AND ONE-QUARTER

205. COMMUNICATIONS WITH TOWER WHEN AIRCRAFT TRANSMITTER OR RECEIVER OR BOTH ARE INOPERATIVE

a. Arriving Aircraft

(1) Receiver inoperative — If you have reason to believe your receiver is inoperative, remain outside or above the airport traffic area until the direction and flow of traffic has been determined, then advise the tower of your type aircraft, position, altitude, intention to land and request that you be controlled with light signals. (See PARA—233 - TRAFFIC CONTROL OF LIGHT SIGNALS.) When you are approximately 3 to 5 miles from the airport, advise the tower of your position and join the airport traffic pattern. From this point on, watch the tower for light signals. Thereafter, if a complete pattern is made, transmit your position downwind and/or turning base leg.

(2) Transmitter inoperative — Remain outside or above the airport traffic area until the direction and flow of traffic has been determined, then join the airport traffic pattern. Monitor the primary local control frequency as depicted on Sectional Charts for landing or traffic information, and look for a light signal which may be addressed to your aircraft. During hours of daylight, acknowledge tower transmissions or light signals by rocking your wings. At night, acknowledge by blinking the landing or navigation lights. To acknowledge tower transmissions during daylight hours, hovering helicopters will turn in the direction of the controlling facility and flash the landing light. While in flight, helicopters should show their acknowledgement of receiving a transmission by making shallow banks in opposite directions. At night, helicopters will acknowledge receipt of transmissions by flashing either the landing or the search light.

(3) Transmitter and receiver inoperative — Remain outside or above the airport traffic area until the direction and flow of traffic has been determined, then join the airport traffic pattern and maintain visual contact with the tower to receive light signals. Acknowledge light signals as noted above.

b. Departing Aircraft

(1) If you experience radio failure prior to leaving the parking area, make every effort to have the equipment repaired. If you are unable to have the malfunction repaired, call the tower by telephone and request authorization to depart without two-way radio communications. If tower authorization is granted, you will be given departure information and requested to monitor the tower frequency or watch for light signals, as appropriate. During daylight hours, acknowledge tower transmissions or light signals by moving the ailerons or rudder. At night, acknowledge by blinking the landing or navigation lights. If radio malfunction occurs after departing the parking area, watch the tower for light signals or monitor tower frequency.

NOTE.— Refer to FAR—91.87 and FAR—91.77.

206. COMMUNICATIONS FOR VFR FLIGHTS

a. FSSs are allocated frequencies for different functions, for Airport Advisory Service the pilot should contact the FSS on 123.6 MHz, for example. Other FSS frequencies are listed with the FSS in the Airport/Facility Directory. If you are in doubt as to what frequency to use to contact an FSS, transmit on 122.1 MHz and advise them of the frequency you are receiving on.

b. On VFR flights, guard the voice channel of VORs for broadcasts and calls from FAA FSSs. Where the VOR voice channel is being utilized for ATIS broadcasts, pilots of VFR flights are urged to guard the voice channel of an adjacent VOR. When in contact with a control facility, notify the controller if you plan to leave the frequency.

207—219. RESERVED

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Section 3. AIRPORT OPERATIONS

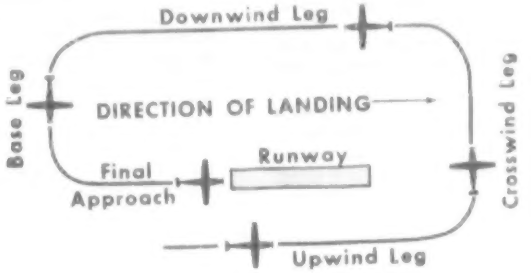
220. GENERAL

Increased traffic congestion, aircraft in climb and descent attitudes, and pilots preoccupation with cockpit duties are some factors that increase the hazardous accident potential near the airport. The situation is further compounded when the weather is marginal — that is, just meeting VFR requirements. Pilots must be particularly alert when operating in the vicinity of an airport. This section defines some rules, practices and procedures that pilots should be familiar with, and adhere to, for safe airport operations.

221. TOWER CONTROLLED AIRPORTS

a. When operating at an airport where traffic control is being exercised by a control tower, pilots are required to maintain two-way radio contact with the tower while operating within the airport traffic area unless the tower authorizes otherwise. Initial call-up should be made about 15 miles from the airport. Unless there is a good reason to leave the tower frequency before exiting the airport traffic area it is a good operating practice to remain on the tower frequency for the purpose of receiving traffic information. In the interest of reducing tower frequency congestion, pilots are reminded that it is not necessary to request permission to leave the tower frequency once outside of the airport traffic area.

b. When necessary, the tower controller will issue clearances or other information for aircraft to generally follow the desired flight path (traffic patterns) when flying in the airport traffic area/control zone, and the proper taxi routes when operating on the ground. If not otherwise authorized or directed by the tower, pilots of fixed-wing aircraft approaching to land must circle the airport to the left. Pilots approaching to land in a helicopter must avoid the flow of fixed-wing traffic. However, in all instances, an appropriate clearance must be received from the tower before landing.



NOTE.— This diagram is intended only to illustrate terminology used in identifying various components of a traffic pattern. It should not be used as a reference or guide on how to enter a traffic pattern.

c. The following terminology for the various components of a traffic pattern has been adopted as standard for use by control towers and pilots:

(1) **Upwind leg —** A flight path parallel to the landing runway in the direction of landing.

(2) **Crosswind leg —** A flight path at right angles to the landing runway off its takeoff end.

(3) **Downwind leg —** A flight path parallel to the landing runway in the opposite direction of landing.

(4) **Base leg —** A flight path at right angles to the landing runway off its approach end and extending from the downwind leg to the intersection of the extended runway centerline.

(5) **Final approach —** A flight path in the direction of landing along the extended runway centerline from the base leg to the runway.

d. Many towers are equipped with a tower radar display. The radar uses are intended to enhance the effectiveness and efficiency of the local control, or tower, position. They are not intended to provide radar services or benefits to pilots except as they may accrue through a more efficient tower operation. The four basic uses are:

(1) **To determine an aircraft's exact location** —This is accomplished by radar identifying the VFR aircraft through any of the techniques available to a radar position; such as having the aircraft ident. Once identified, the aircraft's position and spatial relationship to other aircraft can be quickly determined and standard instructions regarding VFR operation in the airport traffic area will be issued. Once initial radar identification of a VFR aircraft has been established and the appropriate instructions have been issued, radar monitoring may be discontinued. The reason being that the local controller's primary means of surveillance in VFR conditions is visually scanning the airport and local area.

(2) To provide radar traffic advisories —Radar traffic advisories may be provided to the extent that the local controller is able to monitor the radar display. Local control has primary control responsibilities to the aircraft operating on the runways which will normally supercede radar monitoring duties.

(3) To provide a direction or suggested heading — The local controller may provide pilots flying VFR with generalized instructions which will facilitate operations (e.g.,"PROCEED SOUTHWEST BOUND, ENTER A RIGHT DOWNWIND RUNWAY THREE ZERO"); or provide a suggested heading to establish radar identification or as an advisory aid to navigation (e.g., "SUGGESTED HEADING TWO TWO ZERO, FOR RADAR IDENTIFICATION"). In both cases, the instructions are advisory aids to the pilot flying VFR and are not radar vectors. PILOTS HAVE COMPLETE DISCRETION REGARDING ACCEPTANCE OF THE SUGGESTED HEADING OR DIRECTION AND HAVE SOLE RESPONSIBILITY FOR SEEING AND AVOIDING OTHER AIRCRAFT.

(4) To provide information and instructions to aircraft operating within the airport traffic area —In an example of this situation, the local controller would use the radar to advise a pilot on an extended downwind when to turn base leg.

NOTE.— The above tower radar applications are intended to augment the standard functions of the local control position. There is no controller requirement to maintain constant radar identification and, in fact, such a requirement could compromise the local controllers ability to visually scan the airport and local area to meet FAA responsibilities to the aircraft operating on the runways and within the airport traffic area. Normally, pilots will not be advised of being in radar contact since that continued status cannot be guaranteed and since the purpose of the radar identification is not to establish a link for the provision of radar services.

e. A few of the radar equipped towers are authorized to use the radar to ensure separation between aircraft in specific situations, while still others may function as limited radar approach controls. The various radar uses are strictly a function of FAA operational need. The facilities may be indistinguishable to pilots since they are all referred to as tower and no publication lists the degree of radar use. Therefore, WHEN IN COMMUNICATION WITH A TOWER CONTROLLER WHO MAY HAVE RADAR AVAILABLE, DO NOT ASSUME THAT CONSTANT RADAR MONITORING AND COMPLETE ATC RADAR SERVICES ARE BEING PROVIDED.

222. VISUAL INDICATORS AT UNCONTROLLED AIRPORTS

a. At those airports *without an operating control tower*, a segmented circle visual indicator system, if installed, is designed to provide traffic pattern information. (See PARA—157 - TRAFFIC ADVISORY PRACTICES AT AIRPORTS WHERE A TOWER IS NOT IN OPERATION). The segmented circle system consists of the following components:

(1) The segmented circle — Located in a position affording maximum visibility to pilots in the air and on the ground and providing a centralized location for other elements of the system.

(2) The Wind Direction Indicator — A wind cone, wind sock, or wind tee installed near the operational runway to indicate wind direction. The large end of the wind cone/wind sock points into the wind as does the large end (cross bar) of the wind tee. In lieu of a tetrahedron and where a wind sock or wind cone is collocated with a wind tee, the wind tee may be manually aligned with the runway in use to indicate landing direction. These signaling devices may be located in the center of the segmented circle and may be lighted for night use. Pilots are cautioned against using a tetrahedron to indicate wind direction.

(3) The Landing Direction Indicator — A tetrahedron is installed when conditions at the airport warrant its use. It may be used to indicate the direction of landings and takeoffs. A tetrahedron may be located at the center of a segmented circle and may be lighted for night operations. The small end of the tetrahedron points in the direction of landing. Pilots are cautioned against using a tetrahedron for any purpose other than as an indicator of landing direction. Further, pilots should use extreme caution when making runway selection by use of a tetrahedron in very light or calm wind conditions as the tetrahedron may not be aligned with the designated calm-wind runway. At airports with control towers, the tetrahedron should only be referenced when the control tower is not in operation. Tower instructions supersede tetrahedron indications.

(4) Landing strip indicators — Installed in pairs as shown in the segmented circle diagram and used to show the alignment of landing strips.

(5) Traffic pattern indicators — Arranged in pairs in conjunction with landing strip indicators and used to indicate the direction of turns when there is a variation from the normal left traffic pattern. (If there is no segmented circle installed at the airport, traffic pattern indicators may be installed on or near the end of the runway.)

b. Preparatory to landing at an airport without a control tower, or when the control tower is not in operation, the pilot should concern himself with the indicator for the approach end of the runway to be used. When approaching for landing, all turns must be made to the left unless a traffic pattern indicator indicates that turns should be made to the right. If the pilot will mentally enlarge the indicator for the runway to be used, the base and final approach legs of the traffic pattern to be flown immediately become apparent. Similar treatment of the indicator at the departure end of the runway will clearly indicate the direction of turn after takeoff.

c. When two or more aircraft are approaching an airport for the purpose of landing, the aircraft at the lower altitude has the right of way, but it shall not take advantage of this rule to cut in front of another which is on final approach to land, or to overtake that aircraft (FAR—91.67(f)).

223. TRAFFIC PATTERNS

At most airports and military air bases, traffic pattern altitudes for propeller driven aircraft generally extend from 600 feet to as high as 1,500 feet above the ground. Also, traffic pattern altitudes for military turbojet aircraft sometimes extend up to 2,500 feet above the ground. Therefore, pilots of en route aircraft should be constantly on the

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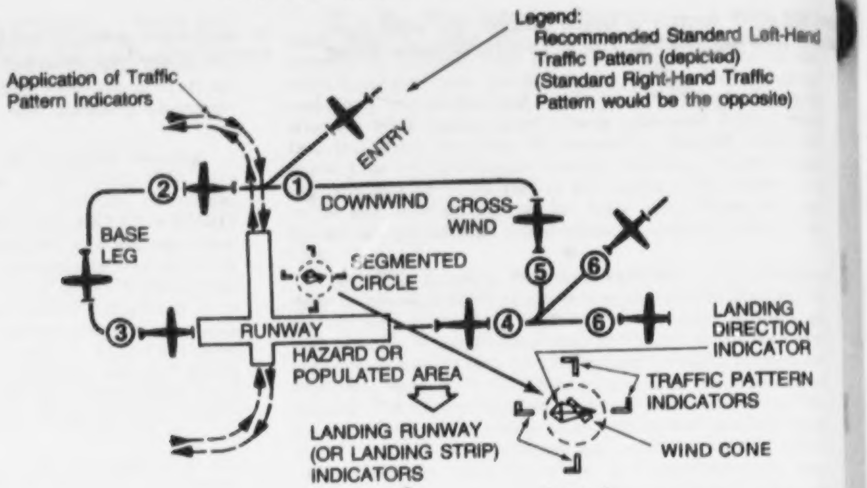
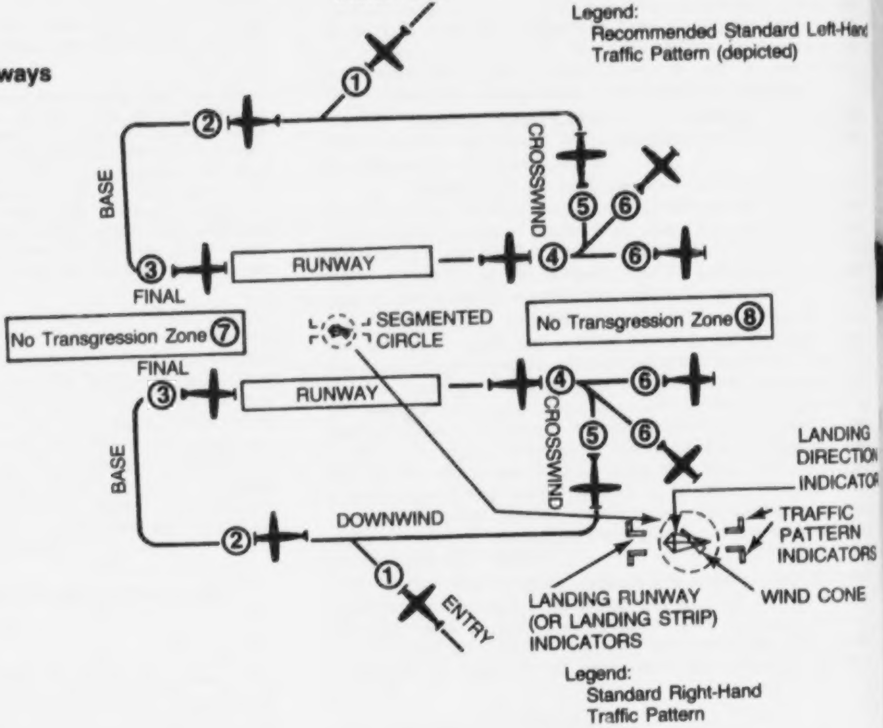
alert for other aircraft in traffic patterns and avoid these areas whenever possible. Traffic pattern altitudes should be maintained unless otherwise required by the applicable distance from cloud criteria (FAR—91.105).

Single Runway


Legend:
Recommended Standard Left-Hand
Traffic Pattern (depicted)
(Standard Right-Hand Traffic
Pattern would be the opposite)
Application of Traffic
Pattern Indicators
ENTRY
① DOWNWIND
CROSS-
WIND
②
BASE
LEG
SEGMENTED
CIRCLE
⑤ ⑥
③
RUNWAY
④
⑥
LANDING
DIRECTION
INDICATOR
HAZARD OR
POPULATED AREA
TRAFFIC PATTERN
INDICATORS
WIND CONE
LANDING RUNWAY
(OR LANDING STRIP)
INDICATORS

Parallel Runways


Legend:
Recommended Standard Left-Hand
Traffic Pattern (depicted)
①
②
BASE
CROSSWIND
⑤ ⑥
③
RUNWAY
④
⑥
FINAL
No Transgression Zone⑦
SEGMENTED
CIRCLE
No Transgression Zone⑧
FINAL
③
RUNWAY
④
⑥
CROSSWIND
⑤ ⑥
BASE
LANDING
DIRECTION
INDICATOR
TRAFFIC
PATTERN
INDICATORS
②
DOWNWIND
①
ENTRY
LANDING RUNWAY
(OR LANDING STRIP)
INDICATORS
WIND CONE
Legend:
Standard Right-Hand
Traffic Pattern

Key:

① Enter pattern in level flight, abeam the midpoint of the runway, at pattern altitude. (1000' AGL is recommended pattern altitude unless established otherwise).

② Maintain pattern altitude until abeam approach end of the landing runway, or downwind leg.

③ Complete turn to final at least ¼ mile from the runway.

④ Continue straight ahead until beyond departure end of runway.

⑤ If remaining in the traffic pattern, commence t to crosswind leg beyond the departure end of t runway, within 300 feet of pattern altitude.

⑥ If departing the traffic pattern, continue straig out, or exit with a 45° left turn beyond the de ture end of the runway, after reaching patter altitude.

⑦ Do not overshoot final or continue on a track which will penetrate the final approach of the parallel runway.

⑧ Do not continue on a track which will penetra the departure path of the parallel runway.

224. UNEXPECTED MANEUVERS IN THE AIRPORT TRAFFIC PATTERN

There have been several incidents in the vicinity of controlled airports that were caused primarily by aircraft executing unexpected maneuvers. ATC service is based upon observed or known traffic and airport conditions. Controllers establish the sequence of arriving and departing aircraft by requiring them to adjust flight as necessary to achieve proper spacing. These adjustments can only be based on observed traffic, accurate pilot reports, and anticipated aircraft maneuvers. Pilots are expected to cooperate so as to preclude disruption of traffic flow or creation of conflicting patterns. The pilot in command of an aircraft is directly responsible for and is the final authority as to the operation of his aircraft. On occasion it may be necessary for a pilot to maneuver his aircraft to maintain spacing with the traffic he has been sequenced to follow. The controller can anticipate minor maneuvering such as shallow "S" turns. The controller cannot, however, anticipate a major maneuver such as a 360 degree turn. If a pilot makes a 360 degree turn after he has obtained a landing sequence, the result is usually a gap in the landing interval and more importantly it causes a chain reaction which may result in a conflict with following traffic and interruption of the sequence established by the tower or approach controller. Should a pilot decide he needs to make maneuvering turns to maintain spacing behind a preceding aircraft, he should always advise the controller if at all possible. Except when requested by the controller or in emergency situations, a 360 degree turn should never be executed in the traffic pattern or when receiving radar service without first advising the controller.

225. RESERVED

226. USE OF RUNWAYS

a. Runways are identified by numbers which indicate the nearest 10-degree increment of the azimuth of the runway centerline. For example, where the magnetic azimuth is 183 degrees, the runway designation would be 18, for a magnetic azimuth of 87 degrees, the runway designation would be 9. For a magnetic azimuth ending in the number 5, such as 185, the runway designation could be either 18 or 19. Wind direction issued by the tower is also magnetic and wind velocity is in knots.

b. Airport proprietors are responsible for taking the lead in local aviation noise control. Accordingly, they may propose specific noise abatement plans to the FAA. If approved, these plans are applied in the form of Formal or Informal Runway Use Programs (see Glossary) for noise abatement purposes.

(1) At airports where no runway use program is established, ATC clearances may specify:

(a) the runway most nearly aligned with the wind when it is 5 knots or more,

(b) the "calm wind" runway when wind is less than 5 knots, or

(c) another runway if operationally advantageous.

NOTE.— It is not necessary for a controller to specifically inquire if the pilot will use a specific runway or to offer him a choice of runways. If a pilot prefers to use a different runway than that specified or the one most nearly aligned with the wind, he is expected to inform ATC accordingly.

(2) At airports where a runway use program is established, ATC will assign runways deemed to have the least noise impact. If in the interest of safety a runway different than that specified is preferred, the pilot is expected to advise ATC accordingly. ATC will honor such requests and advise pilots when the requested runway is noise sensitive. When use of a runway other than the one assigned is requested, pilot cooperation is encouraged to preclude disruption of traffic flows or creation of conflicting patterns.

227. LOW LEVEL WIND SHEAR ALERT SYSTEM (LLWAS)

a. This computerized system detects the presence of a possible hazardous low-level wind shear by continuously comparing the winds measured by sensors installed around the periphery of an airport with the wind measured at the centerfield location. If the difference between the centerfield wind sensor and a peripheral wind sensor becomes excessive, a thunderstorm or thunderstorm gust front wind shear is probable. When this condition exists, the tower controller will provide arrival and departure aircraft with an advisory of the situation which includes the centerfield wind plus the remote site location and wind.

b. Since the sensors are not all associated with specific runways, descriptions of the remote sites will be based on an eight point compass system.

EXAMPLE:

DELTA ONE TWENTY FOUR CENTERFIELD WIND TWO SEVEN ZERO AT ONE ZERO. SOUTH BOUNDARY WIND ONE FOUR ZERO AT THREE ZERO.

c. An airport equipped with the Low Level Wind Shear Alert System is so indicated in the Airport/Facility Directory under *Weather Data Sources* for that particular airport.

228. BRAKING ACTION REPORTS

a. ATC furnishes pilots the quality of braking action received from pilots or the airport management. The quality of braking action is described by the terms "good," "fair," "poor," and "nil" or a combination of these terms. Where available from airport management numerical readings from friction measuring devices, such as Mu-Meter, Saab Friction Tester, Skidometer, and Tapley Meter will be issued at pilot's request.

b. Pilots should describe the quality of braking action by using the terms noted above. In describing braking action for a portion of a runway, pilots should use descriptive terms that are easily understood, such as, "braking action poor the first/last half of the runway." Reports reference to local landmarks, buildings, etc., should be avoided.

229. BRAKING ACTION ADVISORIES

a. When tower controllers have received runway braking action reports which include the terms *poor* or *nil*, or whenever weather conditions are conducive to deteriorating or rapidly changing runway braking conditions, the tower will include on the ATIS broadcast the statement, "*BRAKING ACTION ADVISORIES ARE IN EFFECT.*"

b. During the time that Braking Action Advisories are in effect, ATC will issue the latest braking action report for the runway in use to each arriving and departing aircraft. Pilots should be prepared for deteriorating braking conditions and should request current runway condition information if not volunteered by controllers. Pilots should also be prepared to provide a descriptive runway condition report to controllers after landing.

230. INTERSECTION TAKEOFFS

a. In order to enhance airport capacities, reduce taxiing distances, minimize departure delays, and provide for more efficient movement of air traffic, controllers may initiate intersection takeoffs as well as approve them when the pilot requests. If for ANY reason a pilot prefers to use a different intersection or the full length of the runway or desires to obtain the distance between the intersection and the runway end, HE IS EXPECTED TO INFORM ATC ACCORDINGLY.

b. An aircraft is expected to taxi to (but not onto) the end of the assigned runway unless prior approval for an intersection departure is received from ground control.

c. Controllers are required to separate small aircraft (12,500 pounds or less, maximum certificated takeoff weight) departing (same or opposite direction) from an intersection behind a large nonheavy aircraft on the same runway, by ensuring that at least a 3-minute interval exists between the time the preceding large aircraft has taken off and the succeeding small aircraft begins takeoff roll. To inform the pilot of the required 3-minute hold, the controller will state, "Hold for wake turbulence." If after considering wake turbulence hazards, the pilot feels that a lesser time interval is appropriate, he may request a waiver to the 3-minute interval. Pilots must initiate such a request by stating, "Request waiver to 3-minute interval," or by making a similar statement. Controllers may then issue a takeoff clearance if other traffic permits, since the pilot has accepted responsibility for his own wake turbulence separation.

d. The 3-minute interval will not be applied when the intersection is 500 feet or less from the threshold and both aircraft are taking off in the same direction. When a small aircraft is departing from an intersection 500 feet or less from the runway threshold behind a large nonheavy aircraft and both aircraft are taking off in the same direction, the 3-minute interval will not be applied. Controllers will issue a clearance to permit the small aircraft to alter course to avoid the flight path of the preceding departure.

e. The 3-minute interval is mandatory behind a heavy aircraft in all cases.

231. SIMULTANEOUS OPERATIONS ON INTERSECTING RUNWAYS

a. Despite the many new and lengthened runwa which have been added to the nation's airports in rece years, limited runway availability remains a major contri uting factor to operational delays. Many high-density a ports have gained operational experience with intersecti runways which clearly indicates that simultaneous op ations are safe and feasible. Tower controllers may auth ize simultaneous landings or a simultaneous landing a takeoff on intersecting runways when the following cond tions are met:

(1) The runways are dry and the controller has r ceived no reports that braking action is less than good.

(2) A simultaneous takeoff and landing operati may be conducted only in VFR conditions between sunri and sunset.

(3) Instructions are issued to restrict one aircra from entering the intersecting runway being used by a other aircraft.

(4) Traffic information issued is acknowledged by th pilots of both aircraft.

(5) The measured distance from runway threshold t intersection is issued if the pilot requests it.

(6) The conditions specified in 3, 4 and 5 are met a or before issuance of the landing clearance.

(7) The distance from landing threshold to the inte section is adequate for the category of aircraft being he short. Controllers are provided a general table of aircra category/minimum runway length requirements as guide. Operators of STOL aircraft should identify their ai craft as such on initial contact with the tower, unles Letter of Agreement concerning this fact, is in effect. IT I INCUMBENT ON THE PILOT TO DETERMINE HI ABILITY TO HOLD SHORT OF AN INTERSECTIO AFTER LANDING, WHEN SO INSTRUCTED.

(8) There is no tailwind for the landing aircraft r stricted to hold short of the intersection.

b. THE SAFETY AND OPERATION OF AN AI CRAFT REMAIN THE RESPONSIBILITY OF TH PILOT. IF FOR ANY REASON, (e.g. DIFFICULTY IN DI CERNING LOCATION OF AN INTERSECTION A NIGHT, INABILITY TO HOLD SHORT OF AN INTE SECTION, WIND FACTORS, ETC.) A PILOT ELECTS T USE THE FULL LENGTH OF THE RUNWAY, A DI FERENT RUNWAY OR DESIRES TO OBTAIN THE DI TANCE FROM THE LANDING THRESHOLD TO TH INTERSECTION, HE IS EXPECTED TO PROMPTL INFORM ATC ACCORDINGLY.

232. LOW APPROACH

a. A low approach (sometimes referred to as a low pa is the go-around maneuver following approach. Instead landing or making a touch-and-go, a pilot may wish to around (low approach) in order to expedite a particular eration — a series of practice instrument approaches is example of such an operation. Unless otherwise author by ATC, the low approach should be made straight ahe with no turns or climb made until the pilot has made a thorough visual check for other aircraft in the area.

b. When operating within an airport traffic area, a pilot intending to make a low approach should contact the tower for approval. This request should be made prior to starting the final approach.

c. When operating to an airport, not within an airport traffic area, a pilot intending to make a low approach should, prior to leaving the final approach fix inbound (non precision approach) or the outer marker or fix used in lieu of the outer marker inbound (precision approach), so advise the FSS, UNICOM, or make a broadcast, as appropriate (See PARA—157 - TRAFFIC ADVISORY PRACTICES AT AIRPORTS WITHOUT OPERATING CONTROL TOWERS).

233. TRAFFIC CONTROL LIGHT SIGNALS

a. The following procedures are used by ATCTs in the control of aircraft, ground vehicles, equipment, and personnel not equipped with radio. These same procedures will be used to control aircraft, ground vehicles, equipment, and personnel equipped with radio if radio contact cannot be established. ATC personnel use a directive traffic control signal which emits an intense narrow light beam of a selected color (either red, white, or green) when controlling traffic by light signals.

b. Although the traffic signal light offers the advantage that some control may be exercised over nonradio equipped aircraft, pilots should be cognizant of the disadvantages which are:

(1) The pilot may not be looking at the control tower at the time a signal is directed toward him.

(2) The directions transmitted by a light signal are very limited since only approval or disapproval of a pilot's anticipated actions may be transmitted. No supplement or explanatory information may be transmitted except by the use of the "General Warning Signal" which advises the pilot to be on the alert.

c. Between sunset and sunrise, a pilot wishing to attract the attention of the control tower should turn on a landing light and taxi the aircraft into a position, clear of the active runway, so that light is visible to the tower. The landing light should remain on until appropriate signals are received from the tower.

d. Air Traffic Control Tower Light Gun Signals:

	MEANING		
COLOR AND TYPE OF SIGNAL	MOVEMENT OF VEHICLES EQUIPMENT AND PERSONNEL	AIRCRAFT ON THE GROUND	AIRCRAFT IN FLIGHT
Steady green	Cleared to cross, proceed or go	Cleared for takeoff	Cleared to land
Flashing green	Not applicable	Cleared for taxi	Return for landing (to be followed by steady green at the proper time)
Steady red	STOP	STOP	Give way to other aircraft and continue circling
Flashing red	Clear the taxiway/runway	Taxi clear of the runway in use	Airport unsafe, do not land
Flashing white	Return to starting point on airport	Return to starting point on airport	Not applicable
Alternating red and green	Exercise extreme caution	Exercise extreme caution	Exercise extreme caution

e. During daylight hours, acknowledge tower transmissions or light signals by moving the ailerons or rudder. At night, acknowledge by blinking the landing or navigation lights. If radio malfunction occurs after departing the parking area, watch the tower for light signals or monitor tower frequency.

234. RESERVED

235. COMMUNICATIONS

a. Pilots of departing aircraft should communicate with the control tower on the appropriate ground control/clearance delivery frequency prior to starting engines to receive engine start time, taxi and/or clearance information. Unless otherwise advised by the tower, remain on that frequency during taxiing and runup, then change to local control frequency when ready to request takeoff clearance. (See PARA. 161 - AUTOMATIC TERMINAL INFORMATION SERVICE (ATIS) for continuous broadcast of terminal information.)

b. The majority of ground control frequencies are in the 121.6—121.9 MHz bandwidth. Ground control frequencies are provided to eliminate frequency congestion on the tower (local control) frequency and are limited to communications between the tower and aircraft on the ground and between the tower and utility vehicles on the airport, provide a clear VHF channel for arriving and departing aircraft. They are used for issuance of taxi information, clear-

ances, and other necessary contacts between the tower and aircraft or other vehicles operated on the airport. A pilot who has just landed should not change from the tower frequency to the ground control frequency until he is directed to do so by the controller. Normally, only one ground control frequency is assigned at an airport; however, at locations where the amount of traffic so warrants, a second ground control frequency and/or another frequency designated as a clearance delivery frequency, may be assigned.

c. A controller may omit the ground or local control frequency if the controller believes the pilot knows which frequency is in use. If the ground control frequency is in the 121 MHz bandwidth the controller may omit the numbers preceding the decimal point; (e.g., 121.7, "CONTACT GROUND POINT SEVEN.") However, if any doubt exists as to what frequency is in use, the pilot should promptly request the controller to provide that information.

d. Controllers will normally avoid issuing a radio frequency change to helicopters, known to be single-piloted, which are hovering, air taxiing, or flying near the ground. At times, it may be necessary for pilots to alert ATC regarding single pilot operations to minimize delay of essential ATC communications. Whenever possible, ATC instructions will be relayed through the frequency being monitored until a frequency change can be accomplished. You must promptly advise ATC if you are unable to comply with a frequency change. Also, you should advise ATC if you must land to accomplish the frequency change unless it is clear the landing, e.g., on a taxiway or in a helicopter operating area, will have no impact on other air traffic.

236. GATE HOLDING DUE TO DEPARTURE DELAYS

a. Pilots should contact ground control or clearance delivery prior to starting engines as gate hold procedures will be in effect whenever departure delays exceed or are anticipated to exceed 5 minutes. The sequence for departure will be maintained in accordance with initial call up unless modified by flow control restrictions. Pilots should monitor the ground control or clearance delivery frequency for engine startup advisories or new proposed start time if the delay changes.

b. The tower controller will consider that pilots of turbine powered aircraft are ready for takeoff when they reach the runway or warm-up block unless advised otherwise.

237. VFR FLIGHTS IN TERMINAL AREAS

Use reasonable restraint in exercising the prerogative of VFR flight, especially in terminal areas. The weather minimums and distances from clouds are minimums. Giving yourself a greater margin in specific instances is just good judgment.

a. Approach Area.

Conducting a VFR operation in a Control Zone when the official visibility is 3 or 4 miles is not prohibited, but good judgment would dictate that you keep out of the approach area.

b. Reduced Visibility.

It has always been recognized that precipitation reduces forward visibility. Consequently, although again it may be perfectly legal to cancel your IFR flight plan at any time you can proceed VFR, it is good practice, when precipitation is occurring, to continue IFR operation into a terminal area until you are reasonably close to your destination.

c. Simulated Instrument Flights.

In conducting simulated instrument flights, be sure that the weather is good enough to compensate for the restricted visibility of the safety pilot and your greater concentration on your flight instruments. Give yourself a little greater margin when your flight plan lies in or near a busy airway or close to an airport.

238. VFR HELICOPTER OPERATIONS AT CONTROLLED AIRPORTS

a. GENERAL

(1) The following ATC procedures and phraseologies recognize the unique capabilities of helicopters and were developed to improve service to all users. Helicopter design characteristics and user needs often require operations from movement and nonmovement areas within the airport boundary. In order for ATC to properly apply these procedures, it is essential that pilots familiarize themselves with the local operations and make it known to controllers when additional instructions are necessary.

(2) Insofar as possible, helicopter operations will be instructed to avoid the flow of fixed-wing aircraft to minimize overall delays; however, there will be many situations where faster/larger helicopters may be integrated with fixed-wing aircraft for the benefit of all concerned. Examples would include IFR flights, avoidance of noise sensitive areas, or use of runways/taxiways to minimize the hazardous effects of rotor downwash in congested areas.

(3) Because helicopter pilots are intimately familiar with the effects of rotor downwash, they are best qualified to determine if a given operation can be conducted safely. Accordingly, the pilot has the final authority with respect to the specific airspeed/altitude combinations. ATC clearances are in no way intended to place the helicopter in a hazardous position. It is expected that pilots will advise ATC if a specific clearance will cause undue hazards to persons or property.

b. Controllers normally limit ATC ground service and instruction to ***movement*** areas; therefore, operations from ***nonmovement*** areas are conducted at pilot discretion and should be based on local policies, procedures, or letters of agreement. In order to maximize the flexibility of helicopter operations, it is necessary to rely heavily on sound pilot judgment. For example, hazards such as debris, obstructions, vehicles, or personnel must be recognized by the pilot, and action should be taken as necessary to avoid such hazards. Taxi, hover taxi, and air taxi operations are considered to be ground movements. Helicopters conducting such operations are expected to adhere to the same conditions, requirements, and practices as apply to other ground taxiing and ATC procedures in the AIM.

(1) The phraseology ***taxi*** is used when it is intended or expected that the helicopter will taxi on the airport surface, either via taxiways or other prescribed routes. ***Taxi*** is used primarily for helicopters equipped with wheels or in response to a pilot request. Preference should be given to this procedure whenever it is necessary to minimize effects of rotor downwash.

(2) Pilots may request a ***hover taxi*** when a slow forward movement is desired, or when it may be appropriate to move very short distances. Pilots should avoid this procedure if rotor downwash is likely to cause damage to parked aircraft, or if blowing dust/snow could obscure visibility. If it is necessary to operate above 25 feet AGL when hover taxiing, the pilot should initiate a request to ATC.

(3) ***Air taxi*** is the preferred method for helicopter ground movements on airports provided ground operations and conditions permit. Unless otherwise requested or instructed, pilots are expected to remain below 100 feet AGL. However, if a higher than normal airspeed or altitude is desired, the request should be made prior to lift-off. The pilot is solely responsible for selecting a safe airspeed for the altitude/operation being conducted. Use of ***air taxi*** enables the pilot to proceed at an optimum airspeed/altitude, minimize downwash effect, conserve fuel, and expedite movement from one point to another. Helicopters should avoid overflight of other aircraft, vehicles, and personnel during air-taxi operations. Caution must be exercised concerning active runways and pilots must be certain that air taxi instructions are understood. Special precautions may be necessary at unfamiliar airports or airports with multiple/intersecting active runways. The taxi procedures in PARA 241 thru PARA 243 also apply. (See Pilot/Controller Glossary - Taxi, Hover Taxi, Air Taxi definitions.)

c. Takeoff and Landing Procedures

(1) Helicopter operations may be conducted from a runway, taxiway, portion of a landing strip, or any clear area which could be used as a landing site such as the scene of an accident, a construction site, or the roof of a building. The terms used to describe designated areas from which helicopters operate are: movement area, landing/takeoff area, apron/ramp, heliport and helipad (see Pilot/Controller Glossary). These areas may be improved or unimproved and may be separate from or located on an airport/heliport. ATC will issue takeoff clearances from ***movement*** areas other than active runways, or in diverse directions from active runways, with additional instructions as necessary. Whenever possible, takeoff clearance will be issued in lieu of extended hover/air taxi operations. Phraseology will be "CLEARED FOR TAKEOFF FROM (taxiway, helipad, runway number, etc.) MAKE RIGHT/LEFT TURN FOR (direction, heading, NAVAID radial) DEPARTURE/DEPARTURE ROUTE (number, name, etc.)." Unless requested by the pilot, downwind takeoffs will not be issued if the tailwind exceeds 5 knots.

(2) Pilots should be alert to wind information as well as to wind indications in the vicinity of the helicopter. ATC should be advised of the intended method of departing. A pilot request to takeoff in a given direction indicates that the pilot is willing to accept the wind condition and controllers will honor the request if traffic permits. Departure points could be a significant distance from the control tower and it may be difficult or impossible for the controller to determine the helicopter's relative position to the wind.

(3) If takeoff is requested from ***nonmovement*** areas, the phraseology "PROCEED AS REQUESTED" will be used. Additional instructions will be issued as necessary. The pilot is responsible for operating in a safe manner and should exercise due caution. When other known traffic is not a factor and takeoff is requested from an area not visible from the tower, an area not authorized for helicopter use, an unlighted area at night, or an area not on the airport, the phraseology "DEPARTURE FROM (location) WILL BE AT YOUR OWN RISK (with reason, and additional instructions as necessary)."

(4) Similar phraseology is used for helicopter landing operations. Every effort will be made to permit helicopters to proceed direct and land as near as possible to their final destination on the airport. Traffic density, the need for detailed taxiing instructions, frequency congestion, or other factors may affect the extent to which service can be expedited. As with ground movement operations, a high degree of pilot/controller cooperation and communication is necessary to achieve safe and efficient operations.

239. RESERVED

240. FUEL ADVISORY DEPARTURE (FAD) PROCEDURES

a. The Air Traffic Operations Service has undertaken several programs designed to conserve aviation fuel. FAD Procedures is one such program.

b. FAD is designed to operate when conditions at an airport are such that arrival delays will exceed one hour, and that the hour or more delay will continue for an extended period. FAD is not designed to eliminate delays, but to absorb, with engine off, any excess of the anticipated one hour delay at the departure terminal. This means absorbing the excess of the hour arrival delay at the departure gate, being assigned a new departure time and then proceeding to destination and holding an hour or less at the destination.

c. Subject to the availability of holding space, FAD offers the pilot or operator options to absorb the delay in the air or on the ground. Of course, delay on the ground with engine off is the key to fuel savings. Options include: ground delay, airborne delay, split ground and airborne delay, intermediate landing (delay at the intermediate airport is credited) or flight substitution.

NOTE.— FAD procedures were tested in a live environment at the Chicago O'Hare Airport. The tests and subsequent programs indicated that significant fuel savings can be realized when the ground delay option is exercised.

d. System users are appraised of the imposition of FAD through ATC Systems Command Center advisories transmitted to all FSSs, and Airline Dispatch Offices. When notified that FAD procedures are in effect, operators are requested to file flight plans to the impacted airport at least 4 hours in advance of departure. The flight plan should include the estimated time en route.

241. TAXIING

a. General: Approval must be obtained prior to moving an aircraft or vehicle onto the movement area during the hours an airport traffic control tower is in operation.

(1) Always state your position on the airport when calling the tower for taxi instructions.

(2) The movement area is normally described in local bulletins issued by the airport manager or control tower.

These bulletins may be found in FSSs, fixed base operators offices, air carrier offices and operations offices.

(3) The control tower also issues bulletins describing areas where they cannot provide ATC service due to nonvisibility or other reasons.

(4) A clearance must be obtained prior to taxiing on a runway, taking off, or landing during the hours an airport traffic control tower is in operation.

(5) When ATC clears an aircraft to "taxi to" an assigned takeoff runway, the absence of holding instructions authorizes the aircraft to "cross" all runways which the taxi route intersects except the assigned takeoff runway. It does not include authorization to "taxi onto" or "cross" the assigned takeoff runway at any point. In order to preclude misunderstandings in radio communications, ATC will not use the word "cleared" in conjunction with authorization for aircraft to taxi.

(6) In the absence of holding instructions, a clearance to "taxi to" any point other than an assigned takeoff runway is a clearance to cross all runways that intersect the taxi route to that point.

(7) When ATC authorizes an aircraft to taxi to an assigned departure runway and hold short instructions will be issued, they will first specify the runway, issue taxi instructions, and then state the hold short instructions. This does not authorize the aircraft to "enter" or "cross" the assigned departure runway at any point.

b. ATC clearances or instructions pertaining to taxiing are predicated on known traffic and known physical airport conditions. Therefore, it is important that pilots clearly understand the clearance or instruction. Although an ATC clearance is issued for taxiing purposes, when operating in accordance with the FARs, it is the responsibility of the pilot to avoid collision with other aircraft. Since "the pilot in command of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft" the pilot should obtain clarification of any clearance or instruction which is not understood. (See PARA—540.)

c. At those airports where the U.S. Government operates the control tower and ATC has authorized noncompliance with the requirement for two-way radio communications while operating within the airport traffic area, or at those airports where the U.S. Government does not operate the control tower and radio communications cannot be established, pilots shall obtain a clearance by visual light signal prior to taxiing on a runway and prior to takeoff and landing.

d. The following phraseologies and procedures are used in radio-telephone communications with aeronautical ground stations.

(1) Request for taxi instructions prior to departure: State your aircraft identification, location, type of operation planned (VFR or IFR) and the point of first intended landing.

EXAMPLE:

Aircraft: "WASHINGTON GROUND, BEECHCRAFT ONE THREE ONE FIVE NINER AT HANGAR EIGHT, READY TO TAXI, IFR TO CHICAGO."

Tower: "BEECHCRAFT ONE THREE ONE FIVE NINER, TAXI TO RUNWAY THREE SIX, WIND ZERO THREE ZERO AT TWO FIVE, ALTIMETER THREE ZERO ZERO FOUR."

Tower: "BEECHCRAFT ONE THREE ONE FIVE NINER, RUNWAY TWO SEVEN, TAXI VIA TAXIWAYS CHARLIE AND DELTA, HOLD SHORT OF RUNWAY THREE THREE LEFT."

(2) Receipt of ATC clearance: ARTCC clearances ar relayed to pilots by airport traffic controllers in the following manner:

EXAMPLE:

Tower: BEECHCRAFT ONE THREE ONE FIVE NINER CLEARED TO THE CHICAGO MIDWAY AIRPORT, VIA VICTOR EIGHT, MAINTAIN EIGHT THOUSAND.

Aircraft: "BEECHCRAFT ONE THREE ONE FIVE NINER CLEARED TO THE CHICAGO MIDWAY AIRPORT, VIA VICTOR EIGHT, MAINTAIN EIGHT THOUSAND."

NOTE.— Normally, an ATC IFR clearance is relayed to a pil by the ground controller. At busy locations, however, pilots may b instructed by the ground controller to "CONTACT CLEARANC DELIVERY" on a frequency designated for this purpose. No su veillance or control over the movement of traffic is exercised b this position of operation.

(3) Request for taxi instructions after landing: Sta your aircraft identification, location, and that you reque taxi instructions.

EXAMPLE:

Aircraft: "DULLES GROUND BEECHCRAFT ON FOUR TWO SIX ONE CLEARING RUNWAY ON RIGHT ON TAXIWAY E3, REQUEST CLEARANC TO PAGE."

Tower: "BEECHCRAFT ONE FOUR TWO SIX ON TAXI TO PAGE VIA TAXIWAYS E3, E1 and E9."

242. TAXI DURING LOW VISIBILITY

a. Pilots and aircraft operators should be constantl aware that during certain low visibility conditions th movement of aircraft and vehicles on airports may not b visible to the tower controller. This may prevent visu confirmation of an aircraft's adherence to taxi instruction Pilots should, therefore, exercise extreme vigilance an proceed cautiously under such conditions.

b. Of vital importance is the need for pilots to noti the controller when difficulties are encountered or at th first indication of becoming disoriented. Pilots should pr ceed with extreme caution when taxiing toward the sa When vision difficulties are encountered pilots should i mediately inform the controller.

243. EXITING THE RUNWAY AFTER LANDING

After landing, unless otherwise instructed by the contr tower, continue to taxi in the landing direction, proceed t the nearest suitable taxiway and exit the runway witho delay. Do not turn on to another runway or make a 1 degree turn to taxi back on an active runway or change t ground control frequency while on the active runway wi out authorization from the tower.

244. PRACTICE INSTRUMENT APPROACHES

a. Various air traffic incidents have indicated the necessity for adoption of measures to achieve more organized and controlled operations where practice instrument approaches are conducted. Practice instrument approaches are considered to be instrument approaches made by either a VFR aircraft not on an IFR flight plan or an aircraft on an IFR flight plan. To achieve this and thereby enhance air safety, it is Air Traffic Operations Service policy to provide for separation of such operations at locations where approach control facilities are located and, as resources permit, at certain other locations served by ARTCCs or parent approach control facilities. Pilot requests to practice instrument approaches may be approved by ATC subject to traffic and workload conditions. Pilots should anticipate that in some instances the controller may find it necessary to deny approval or withdraw previous approval when traffic conditions warrant. It must be clearly understood, however, that even though the controller may be providing separation, pilots on VFR flight plans are required to comply with basic visual flight rules (FAR—91.105). Application of ATC procedures or any action taken by the controller to avoid traffic conflictions does not relieve IFR and VFR pilots of their responsibility to see and avoid other traffic while operating in VFR conditions. (FAR—91.67) In addition to the normal IFR separation minima (which includes visual separation) during VFR conditions, 500 feet vertical separation may be applied between VFR aircraft and between a VFR aircraft and the IFR aircraft. Pilots not on IFR flight plans desiring practice instrument approaches should always state 'practice' when making requests to ATC. Controllers will instruct VFR aircraft requesting an instrument approach to maintain VFR. This is to preclude misunderstandings between the pilot and controller as to the status of the aircraft. If the pilot wishes to proceed in accordance with instrument flight rules, he must specifically request and obtain, an IFR clearance.

b. Before practicing an instrument approach, pilots should inform the approach control facility or the tower of the type of practice approach they desire to make and how they intend to terminate it, i.e., full-stop landing, touch-and-go, or missed or low approach maneuver. This information may be furnished progressively when conducting a series of approaches. Pilots on an IFR flight plan, who have made a series of instrument approaches to full stop landings should inform ATC when they make their final landing. The controller will control flights practicing instrument approaches so as to ensure that they do not disrupt the flow of arriving and departing itinerant IFR or VFR aircraft. The priority afforded itinerant aircraft over practice instrument approaches is not intended to be so rigidly applied that it causes grossly inefficient application of services. A minimum delay to itinerant traffic may be appropriate to allow an aircraft practicing an approach to complete that approach.

c. At airports without a tower, pilots wishing to make practice instrument approaches should notify the facility having control jurisdiction of the desired approach as indicated on the approach chart. All approach control facilities and ARTCCs are required to publish a facility bulletin depicting those airports where they provide standard separation to both VFR and IFR aircraft conducting practice instrument approaches.

d. The Controller will provide approved separation between both VFR and IFR aircraft when authorization is granted to make practice approaches to airports where an approach control facility is located and to certain other airports served by approach control or an ARTCC. Controller responsibility for separation of VFR aircraft begins at the point where the approach clearance becomes effective, or when the aircraft enters TRSA/TCA airspace, whichever comes first.

e. VFR aircraft practicing instrument approaches are not automatically authorized to execute the missed approach procedure. This authorization must be specifically requested by the pilot and approved by the controller. Separation will not be provided unless the missed approach has been approved by ATC.

f. Except in an emergency, aircraft cleared to practice instrument approaches must not deviate from the approved procedure until cleared to do so by the controller.

g. At radar approach control locations when a full approach procedure (procedure turn, etc.) cannot be approved, pilots should expect to be vectored to a final approach course for a practice instrument approach which is compatible with the general direction of traffic at that airport.

h. When granting approval for a practice instrument approach, the controller will usually ask the pilot to report to the tower prior to or over the final approach fix inbound (non precision approaches) or over the outer marker or fix used in lieu of the outer marker inbound (precision approaches).

i. When authorization is granted to conduct practice instrument approaches to an airport with a tower, but where approved standard separation is not provided to aircraft conducting practice instrument approaches, the tower will approve the practice approach, instruct the aircraft to maintain VFR and issue traffic information, as required.

j. When an aircraft notifies a FSS providing Airport Advisory Service to the airport concerned of the intent to conduct a practice instrument approach and whether or not separation is to be provided, the pilot will be instructed to contact the appropriate facility on a specified frequency prior to initiating the approach. At airports where separation is not provided, the FSS will acknowledge the message and issue known traffic information but will neither approve or disapprove the approach.

k. Pilots conducting practice instrument approaches should be particularly alert for other aircraft operating in the local traffic pattern or in proximity to the airport.

245. OPTION APPROACH

The "Cleared for the Option" procedure will permit an instructor, flight examiner or pilot the option to make a touch-and-go, low approach, missed approach, stop-and-go, or full stop landing. This procedure can be very beneficial in a training situation in that neither the student pilot nor examinee would know what maneuver would be accomplished. The pilot should make his request for this procedure passing the final approach fix inbound on an instrument approach or entering downwind for a VFR traffic pattern. The advantages of this procedure as a training aid are that it enables an instructor or examiner to obtain the reaction of a trainee or examinee under changing conditions, the pilot would not have to discontinue an approach in the middle of the procedure due to student error or pilot proficiency requirements, and finally it allows more flexibility and economy in training programs. This procedure will only be used at those locations with an operational control tower and will be subject to ATC approval.

246. USE OF AIRCRAFT LIGHTS

a. Aircraft position and anticollision lights are required to be lighted on aircraft operated from sunset to sunrise. Anticollision lights, however, need not be lighted when the pilot in command determines that, because of operating conditions, it would be in the interest of safety to turn off the lights (FAR—91.73). For example, strobe lights should be turned off on the ground when they adversely affect ground personnel or other pilots, and in flight when there are adverse reflection from clouds.

b. An aircraft anticollision light system can use one or more rotating beacons and/or strobe lights, be colored either red or white, and have different (higher than minimum) intensities when compared to other aircraft. Many aircraft have both a rotating beacon and a strobe light system.

c. The FAA has a voluntary pilot safety program, *Operation Lights On*, to enhance the *see-and-avoid* concept. Pilots are encouraged to turn on their anticollision lights any time the engine(s) are running, day or night. Pilots are also encouraged to turn on their landing lights during takeoff; i.e., either after takeoff clearance has been received or when beginning takeoff roll. Pilots are further encouraged to turn on their landing lights when operating within 10 miles of any airport, day or night, in conditions of reduced visibility and in areas where flocks of birds may be expected, i.e., coastal areas, lake areas, around refuse dumps, etc. Although turning on aircraft lights does enhance the *see-and-avoid* concept, pilots should not become complacent about keeping a sharp lookout for other aircraft. Not all aircraft are equipped with lights and some pilots may not have their lights turned on. Aircraft manufacturer's recommendations for operation of landing ligh
and electrical systems should be observed.

d. Prop and jet blast forces generated by large aircra
have overturned or damaged several smaller aircraft tax
ing behind them. To avoid similar results, and in the inte
est of preventing upsets and injuries to ground personne
from such forces, the FAA recommends that air carrier
and commercial operators turn on their rotating beacon
anytime their aircraft engines are in operation. Gener
aviation pilots using rotating beacon equipped aircraft ar
also encouraged to participate in this program which is d
signed to alert others to the potential hazard. Since this i
a voluntary program, exercise caution and do not rel
solely on the rotating beacon as an indication that aircra
engines are in operation.

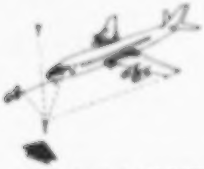
247. FLIGHT INSPECTION/'FLIGHT CHECK' AIRCRAFT IN TERMINAL AREAS

a. *Flight check* is a call sign used to alert pilots and a
traffic controllers when a FAA aircraft is engaged in fligh
inspection/certification of NAVAIDs and flight procedure
Flight Check aircraft fly preplanned high/low altitud
flight patterns such as grids, orbits, DME arcs, and track
including low passes along the full length of the runway t
verify NAVAID performance. In most instances, the
flight checks are being automatically recorded and/o
flown in an automated mode.

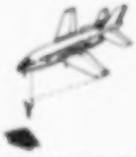
b. Pilots should be especially watchful and avoid th
flight paths of any aircraft using the call sign "Fligh
Check" or "Flight Check recorded." The latter call sig
e.g. "Flight Check 47 recorded" indicates that automate
flight inspections are in progress in terminal areas. The
flights will normally receive special handling from ATC
Pilot patience and cooperation in allowing uninterrupte
recordings can significantly help expedite flight insp
tions, minimize costly, repetitive runs, and reduce th
burden on the U.S. taxpayer.

248—258 RESERVED.

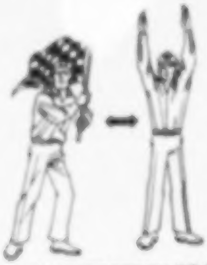
259. HAND SIGNALS



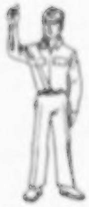
SIGNALMAN DIRECTS TOWING



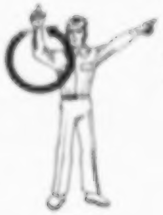
SIGNALMAN'S POSITION



FLAGMAN DIRECTS PILOT TO SIGNALMAN IF TRAFFIC CONDITIONS REQUIRE

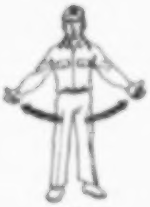


ALL CLEAR (O.K.)

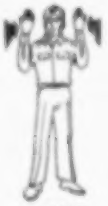


POINT TO ENGINE TO BE STARTED

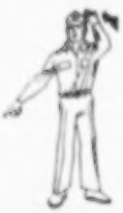
START ENGINE



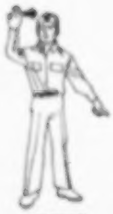
PULL CHOCKS



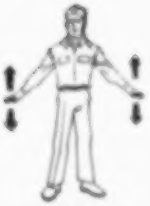
COME AHEAD



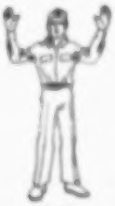
LEFT TURN



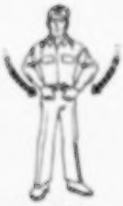
RIGHT TURN



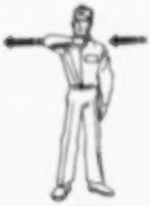
SLOW DOWN



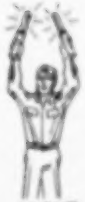
STOP



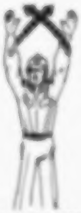
INSERT CHOCKS



CUT ENGINES



NIGHT OPERATION
(Uses same hand movements as day operation)



EMERGENCY STOP

NOTES

Section 4. ATC CLEARANCES/SEPARATIONS

260. CLEARANCE

a. A clearance issued by ATC is predicated on known traffic and known physical airport conditions. An ATC clearance means an authorization by ATC, for the purpose of preventing collision between known aircraft, for an aircraft to proceed under specified conditions within controlled airspace. IT IS NOT AUTHORIZATION FOR A PILOT TO DEVIATE FROM ANY RULE REGULATION OR MINIMUM ALTITUDE NOR TO CONDUCT UNSAFE OPERATION OF HIS AIRCRAFT.

b. FAR—91.3(a) states: "The pilot in command of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft." If ATC issues a clearance that would cause a pilot to deviate from a rule or regulation, or in the pilot's opinion, would place the aircraft in jeopardy, IT IS THE PILOT'S RESPONSIBILITY TO REQUEST AN AMENDED CLEARANCE. Similarly, if a pilot prefers to follow a different course of action, such as make a 360 degree turn for spacing to follow traffic when established in a landing or approach sequence, land on a different runway, takeoff from a different intersection, takeoff from the threshold instead of an intersection or delay his operation, HE IS EXPECTED TO INFORM ATC ACCORDINGLY. When he requests a different course of action, however, the pilot is expected to cooperate so as to preclude disruption of traffic flow or creation of conflicting patterns. The pilot is also expected to use the appropriate aircraft call sign to acknowledge all ATC clearances, frequency changes, or advisory information.

c. When weather conditions permit, during the time an IFR flight is operating, it is the direct responsibility of the pilot to avoid other aircraft since VFR flights may be operating in the same area without the knowledge of ATC. Traffic clearances provide standard separation only between IFR flights.

261. CLEARANCE PREFIX

A clearance, control information, or a response to a request for information originated by an ATC facility and relayed to the pilot through an air to ground communication station will be prefixed by "ATC CLEARS," "ATC ADVISES," or "ATC REQUESTS."

262. CLEARANCE ITEMS

ATC clearances normally contain the following:

a. Clearance Limit. — The traffic clearance issued prior to departure will normally authorize flight to the airport of intended landing. Under certain conditions, at some locations a short-range clearance procedure is utilized whereby a clearance is issued to a fix within or just outside of the terminal area and the pilot is advised of the frequency on which he will receive the long-range clearance direct from the center controller.

b. Departure Procedure. — Headings to fly and altitude restrictions may be issued to separate a departure from other air traffic in the terminal area. (See PARA—322 - ABBREVIATED IFR DEPARTURE CLEARANCE PROCEDURES and PARA—325 - INSTRUMENT DEPARTURES.) Where the volume of traffic warrants, SIDs have been developed.

c. Route of Flight.

(1) Clearances are normally issued for the altitude or flight level and route filed by the pilot. However, due to traffic conditions, it is frequently necessary for ATC to specify an altitude or flight level or route different from that requested by the pilot. In addition, flow patterns have been established in certain congested areas, or between congested areas, whereby traffic capacity is increased by routing all traffic on preferred routes. Information on these flow patterns is available in offices where preflight briefing is furnished or where flight plans are accepted.

(2) When required, air traffic clearances include data to assist pilots in identifying radio reporting points. It is the responsibility of the pilot to notify ATC immediately if his radio equipment cannot receive the type of signals he must utilize to comply with his clearance.

d. Altitude Data.

(1) The altitude or flight level instructions in an ATC clearance normally require that a pilot "MAINTAIN" the altitude or flight level at which the flight will operate when in controlled airspace. Altitude or flight level changes while en route should be requested prior to the time the change is desired.

(2) When possible, if the altitude assigned is different from the altitude requested by the pilot, ATC will inform the pilot when to expect climb or descent clearance or to request altitude change from another facility. If this has not been received prior to crossing the boundary of the ATC facility's area and assignment at a different altitude is still desired, the pilot should reinitiate his request with the next facility.

(3) The term "CRUISE" may be used instead of "MAINTAIN" to assign a block of airspace, to a pilot, from the minimum IFR altitude up to and including the altitude specified in the cruise clearance. The pilot may level off at any intermediate altitude within this block of airspace. Climb/descent within the block is to be made at the discretion of the pilot. However, once the pilot starts descent and verbally reports leaving an altitude in the block, he may not return to that altitude without additional ATC clearance.

NOTE.— See definition of CRUISE in the PILOT CONTROLLER GLOSSARY.

e. Holding Instructions.

(1) Whenever an aircraft has been cleared to a fix other than the destination airport and delay is expected, it is the responsibility of the ATC controller to issue complete holding instructions (unless the pattern is charted), an EFC time, and his best estimate of any additional en route/terminal delay.

(2) If the holding pattern is charted and the controller doesn't issue complete holding instructions, the pilot is expected to hold as depicted on the appropriate chart. When the pattern is charted, the controller may omit all holding instructions except the charted holding direction and the statement *AS PUBLISHED*, e.g., *"HOLD EAST AS PUBLISHED."* Controllers shall always issue complete holding instructions when pilots request them.

NOTE.— · Only those holding patterns depicted on U.S. Government or commercially produced (meeting FAA requirements) *Low/High Altitude En route, and Area or Star charts* should be used.

(3) If no holding pattern is charted and holding instructions have not been issued, the pilot should ask ATC for holding instructions prior to reaching the fix. This procedure will eliminate the possibility of an aircraft entering a holding pattern other than that desired by ATC. If the pilot is unable to obtain holding instructions prior to reaching the fix (due to frequency congestion, stuck microphone, etc.), he should hold in a standard pattern on the course on which he approached the fix and request further clearance as soon as possible. In this event, the altitude/flight level of the aircraft at the clearance limit will be protected so that separation will be provided as required.

(4) When an aircraft is 3 minutes or less from a clearance limit and a clearance beyond the fix has not been received, the pilot is expected to start a speed reduction so that he will cross the fix, initially, at or below the maximum holding airspeed.

(5) When no delay is expected, the controller should issue a clearance beyond the fix as soon as possible and, whenever possible, at least 5 minutes before the aircraft reaches the clearance limit.

(6) Pilots should report to ATC the time and altitude/flight level at which the aircraft reaches the clearance limit and report leaving the clearance limit.

NOTE.— In the event of two-way communications failure, pilots are required to comply with FAR 91.127.

263. AMENDED CLEARANCES

a. Amendments to the initial clearance will be issued at any time an air traffic controller deems such action necessary to avoid possible confliction between aircraft. Clearances will require that a flight "hold" or change altitude prior to reaching the point where standard separation from other IFR traffic would no longer exist.

NOTE.— Some pilots have questioned this action and requested "traffic information" and were at a loss when the reply indicated "no traffic report." In such cases the controller has taken action to prevent a traffic confliction which would have occurred at a distant point.

b. A pilot may wish an explanation of the handling of his flight at the time of occurrence; however, controllers are not able to take time from their immediate control duties nor can they afford to overload the ATC communications channels to furnish explanations. Pilots may obtain an explanation by directing a letter or telephone call to the chief controller of the facility involved.

c. The pilot has the privilege of requesting a different clearance from that which has been issued by ATC if he feels that he has information which would make another course of action more practicable or if aircraft equipment limitations or company procedures forbid compliance with the clearance issued.

264. SPECIAL VFR CLEARANCES

a. An ATC clearance must be obtained *prior* to operating within a control zone when the weather is less than that required for VFR flight. A VFR pilot may request and be given a clearance to enter, leave or operate within most control zones in special VFR conditions, traffic permitting, and providing such flight will not delay IFR operations. All special VFR flights must remain clear of clouds. The visibility requirements for Special VFR fixed-wing aircraft are:

(1) One mile flight visibility for operations within the control zone.

(2) One mile ground visibility if taking off or landing.

b. When a control tower is located within the control zone, requests for clearances should be to the tower. If no tower is located within the control zone, a clearance may be obtained from the nearest tower, FSS or center.

c. It is not necessary to file a complete flight plan with the request for clearance but the pilot should state his intentions in sufficient detail to permit ATC to fit his flight into the traffic flow. The clearance will not contain a specific altitude as the pilot must remain clear of clouds. The controller may require the pilot to fly at or below a certain altitude due to other traffic, but the altitude specified will permit flight at or above the minimum safe altitude. In addition, at radar locations, flights may be vectored if necessary for control purposes or on pilot request.

NOTE. The pilot is responsible for obstacle or terrain clearance (reference FAR—91.79).

d. Special VFR clearances are effective within control zones only. ATC does not provide separation after an aircraft leaves the control zone on a special VFR clearance.

e. Special VFR operations by fixed-wing aircraft are prohibited in some control zones due to the volume of IFR traffic. A list of these control zones is contained in FAR—93.113. They are also depicted on Sectional Aeronautical Charts.

f. ATC provides separation between special VFR flights and between these flights and other IFR flights.

g. Special VFR operations by fixed-wing aircraft are prohibited between sunset and sunrise unless the pilot is instrument rated and the aircraft is equipped for IFR flight.

265. PILOT RESPONSIBILITY UPON CLEARANCE ISSUANCE

a. **RECORD ATC CLEARANCE —** When conducting an IFR operation, make a written record of your clearance. The specified conditions which are a part of your air traffic clearance may be somewhat different from those included in your flight plan. Additionally, ATC may find it necessary to ADD conditions, such as particular departure route. The very fact that ATC specifies different or additional conditions means that other aircraft are involved in the traffic situation.

b. **ATC CLEARANCE/INSTRUCTION READBACK —** Pilots of airborne aircraft should read back *those parts of*

ATC clearances and instructions containing altitude assignments or vectors, as a means of mutual verification. The readback of the "numbers" serves as a double check between pilots and controllers and reduces the kinds of communications errors that occur when a number is either "misheard" or is incorrect.

(1) Precede all readbacks and acknowledgements with the aircraft identification. This aids controllers in determining that the correct aircraft received the clearance or instruction. The requirement to include aircraft identification in all readbacks and acknowledgements becomes more important as frequency congestion increases and when aircraft with similar call signs are on the same frequency.

(2) Read back altitudes, altitude restrictions, and vectors in the same sequence as they are given in the clearance or instruction.

(3) Altitudes contained in charted procedures such as SIDs, instrument approaches, etc., should not be read back unless they are specifically stated by the controller.

c. It is the responsibility of the pilot to accept or refuse the clearance issued.

266. IFR CLEARANCE VFR-ON-TOP

a. A pilot on an IFR flight plan operating in VFR weather conditions, may request VFR ON TOP in lieu of an assigned altitude. This would permit the pilot to select an altitude or flight level of his choice (subject to any ATC restrictions.)

b. Pilots desiring to climb through a cloud, haze, smoke, or other meteorological formation and then either cancel their IFR flight plan or operate VFR ON TOP may request a climb to VFR ON TOP. The ATC authorization shall contain either a top report or a statement that no top report is available, and a request to report reaching VFR ON TOP. Additionally, the ATC authorization may contain a clearance limit, routing and an alternative clearance if VFR ON TOP is not reached by a specified altitude.

c. A pilot on an IFR flight plan, operating in VFR conditions, may request to climb/descend in VFR conditions.

d. ATC may not authorize VFR ON TOP/VFR CONDITIONS operations unless the pilot requests the VFR operation or a clearance to operate in VFR CONDITIONS will result in noise abatement benefits where part of the IFR departure route does not conform to an FAA approved noise abatement route or altitude.

e. When operating in VFR conditions with an ATC authorization to "MAINTAIN VFR ON TOP/MAINTAIN VFR CONDITIONS" pilots on IFR flight plans must:

(1) Fly at the appropriate VFR altitude as prescribed in FAR—91.109.

(2) Comply with the VFR visibility and distance from cloud criteria in FAR—91.105 (BASIC VFR WEATHER MINIMUMS.)

(3) Comply with instrument flight rules that are applicable to this flight (i.e., *minimum IFR altitudes*, position reporting, radio communications, course to be flown, adherence to ATC clearance, etc.).

NOTE.— Pilots should advise ATC prior to any altitude change to insure the exchange of accurate traffic information.

f. ATC authorization to "MAINTAIN VFR ON TOP" is not intended to restrict pilots so that they must operate only *above* an obscuring meteorological formation (layer). Instead, it permits operation above, below, between layers or in areas where there is no meteorological obscuration. It is imperative, however, that pilots understand that clearance to operate "VFR ON TOP/VFR CONDITIONS" does not imply cancellation of the IFR flight plan.

g. Pilots operating VFR ON TOP/VFR CONDITIONS, may receive traffic information, from ATC, on other pertinent IFR or VFR aircraft. However, aircraft operating in TCAs/TRSAs shall be separated as required by FAA Handbook 7110.65.

NOTE.— When operating in VFR weather conditions, it is the pilot's responsibility to be vigilant so as to see and avoid other aircraft.

h. ATC will not authorize VFR or VFR ON TOP operations in PCAs. (See PARA—93 - POSITIVE CONTROL AREA.)

267—269. RESERVED

270. ADHERENCE TO CLEARANCE

a. When air traffic clearance has been obtained under either Visual or Instrument Flight Rules, the pilot in command of the aircraft shall not deviate from the provisions thereof unless an amended clearance is obtained. When ATC issues a clearance or instruction pilots are expected to execute its provisions upon receipt. ATC, in certain situations, will include the word "IMMEDIATELY" in a clearance or instruction to immpress urgency of an imminent situation and expeditious compliance by the pilot is expected and necessary for safety. The addition of a VFR or other restriction (i.e., climb or descent point or time, crossing altitude, etc.) does not authorize a pilot to deviate from the route of flight or any other provision of the ATC clearance.

b. When a heading is assigned or a turn is requested by ATC, pilots are expected to promptly initiate the turn, to complete the turn, and maintain the new heading unless issued additional instructions.

c. The term "at pilot's discretion" included in the altitude information of an ATC clearance means that ATC has offered the pilot the option to start climb or descent when he wishes. He is authorized to conduct the climb or descent at any rate he wishes, and to temporarily level off at any intermediate altitude he may desire. However, once he has vacated an altitude, he may not return to that altitude.

d. When ATC has not used the term "AT PILOT'S DISCRETION" nor imposed any climb or descent restrictions, pilots should initiate climb or descent promptly on acknowledgement of the clearance. Descend or climb at an optimum rate consistent with the operating characteristics of the aircraft to 1,000 feet above or below the assigned altitude, and then attempt to descend or climb at a rate of 500 feet per minute until the assigned altitude is reached. If at anytime the pilot is unable to climb or descend at a rate of at least 500 feet a minute, advise ATC. If it is necessary to level off at an intermediate altitude during climb or descent, advise ATC, except for level off at 10,000 feet MSL on descent or 3,000 feet above airport elevation (prior to entering an airport traffic area), when required for speed reduction (FAR—91.70).

NOTE.— Leveling off at 10,000 feet MSL on descent, or 3,000 feet above airport elevation (prior to entering in an airport traffic area), to comply with FAR—91.70 airspeed restrictions, is commonplace. Controllers anticipate this action and plan accordingly. Leveling off at any other time, on climb or descent, may seriously affect air traffic handling by ATC. Consequently, it is imperative that pilots make every effort to fulfill the above expected actions to aid ATC in safely handling and expediting traffic.

e. If the altitude information of an ATC DESCENT clearance includes a provision to "CROSS (fix) AT or AT OR ABOVE/BELOW (altitude)," "the manner in which the descent is executed to comply with the crossing altitude is at the pilot's discretion." This authorization to descend at pilot's discretion is only applicable to that portion of the flight to which the crossing altitude restriction applies, and the pilot is expected to comply with the crossing altitude as a provision of the clearance. Any other clearance in which pilot execution is optional will so state: "AT PILOT'S DISCRETION."

EXAMPLE:

"UNITED FOUR SEVENTEEN, DESCEND AND MAINTAIN SIX THOUSAND."

NOTE.— The pilot is expected to commence descent upon receipt of the clearance, and to descend at the suggested rates until reaching the assigned altitude of 6,000 feet.

EXAMPLE:

"UNITED FOUR SEVENTEEN, DESCEND AT PILOT'S DISCRETION, MAINTAIN SIX THOUSAND."

NOTE.— The pilot is authorized to conduct descent within the context of the term AT PILOT'S DISCRETION as described above.

EXAMPLE:

"UNITED FOUR SEVENTEEN, CROSS LAKEVIEW VOR AT OR ABOVE FLIGHT LEVEL TWO ZERO ZERO, DESCEND AND MAINTAIN SIX THOUSAND."

NOTE.— The pilot is authorized to conduct descent AT PILOT'S DISCRETION until reaching Lakeview VOR. He must comply with the clearance provision to cross the Lakeview VOR at or above FL 200. After passing Lakeview VOR, he is expected to descend at the suggested rates until reaching the assigned altitude of 6,000 feet.

EXAMPLE:

"UNITED FOUR SEVENTEEN, CROSS LAKEVIEW VOR AT SIX THOUSAND, MAINTAIN SIX THOUSAND."

NOTE.— The pilot is authorized to conduct descent AT PILOT'S DISCRETION, however, he must comply with the clearance provision to cross the Lakeview VOR at 6,000 feet.

EXAMPLE:

"UNITED FOUR SEVENTEEN, DESCEND NOW TO FLIGHT LEVEL TWO SEVEN ZERO, CROSS LAKEVIEW VOR AT OR BELOW ONE ZERO THOUSAND, DESCEND AND MAINTAIN SIX THOUSAND."

NOTE.— The pilot is expected to promptly execute and complete descent to FL 270 upon receipt of the clearance. After reaching FL 270 he is authorized to descend "at pilot's discretion" until reaching Lakeview VOR. He must comply with the clearance provision to cross Lakeview VOR at or below 10,000 feet. After Lakeview VOR he is expected to descend at the suggested rates until reaching 6,000 feet.

f. In case emergency authority is used to deviate from provisions of an ATC clearance, the pilot in command shall notify ATC as soon as possible and obtain an amended clearance. In an emergency situation which does not result in a deviation from the rules prescribed in FAR—91 but which requires ATC to give priority to an aircraft, the pilot of such aircraft shall, when requested by ATC, make a report within 48 hours of such emergency situation to the chief of that ATC facility.

g. The guiding principle is that the last ATC clearance has precedence over the previous ATC clearance. When the route or altitude in a previously issued clearance is amended, the controller will restate applicable altitude restrictions. If altitude to maintain is changed or restated, whether prior to departure or while airborne, and previously issued altitude restrictions are omitted, those altitude restrictions are canceled, including SID altitude restrictions.

EXAMPLE:

A departure flight receives a clearance to destination airport to maintain FL 290. The clearance incorporates a SID which has certain altitude crossing restrictions. Shortly after takeoff, the flight receives a new clearance changing the maintaining FL from 290 to 250. If the altitude restrictions are still applicable, the controller restates them.

EXAMPLE:

A departing aircraft is cleared to cross Fluky intersection at or above 3,000 feet, Gordonville VOR at or above 12,000 feet, maintain FL 200. Shortly after departure, the altitude to be maintained is changed to FL 240. If the altitude restrictions are still applicable, the controller issues an amended clearance as follows: "CROSS FLUKY INTERSECTION AT OR ABOVE THREE THOUSAND, CROSS GORDONVILLE VOR AT OR ABOVE ONE TWO THOUSAND, MAINTAIN FLIGHT LEVEL TWO FOUR ZERO.":

EXAMPLE:

An arriving aircraft is cleared to his destination airport via V45 Delta VOR direct, he is cleared to cross Delta VOR at 10,000 feet and then to, maintain 6,000 feet. Prior to Delta VOR, the controller issues amended clearance as follows: "TURN RIGHT HEADING ONE EIGHT ZERO FOR VECTOR TO RUNWAY THREE SIX ILS APPROACH, MAINTAIN 6,000."

NOTE.— Because the altitude restriction "cross Delta VOR at 10,000 feet" was omitted from the amended clearance, it is no longer in effect.

h. Pilots of turbojet aircraft equipped with afterburner engines should advise ATC prior to takeoff if they intend to use afterburning during their climb to the en route altitude. Often, the controller may be able to plan his traffic to accommodate a high performance climb and allow the pilot to climb to his planned altitude without restriction.

271. IFR SEPARATION STANDARDS

a. ATC effects separation of aircraft vertically by assigning different altitudes; longitudinally by providing an interval expressed in time or distance between aircraft on the same, converging, or crossing courses, and laterally by assigning different flight paths.

b. Separation will be provided between all aircraft operating on IFR flight plans except during that part of the flight (outside of a TCA or TRSA) being conducted on a VFR ON TOP/ VFR CONDITIONS clearance. Under these

conditions, ATC may issue traffic advisories but it is the sole responsibility of the pilot to be vigilant so as to see and avoid other aircraft.

c. When radar is employed in the separation of aircraft at the same altitude, a minimum of 3 miles separation is provided between aircraft operating within 40 miles of the radar antenna site, and 5 miles between aircraft operating beyond 40 miles from the antenna site. These minima may be increased or decreased in certain specific situations.

272. SPEED ADJUSTMENTS

a. To avoid excessive vectoring, ATC may request pilots of radar controlled aircraft to adjust speed.

b. ATC will express all speed adjustments in terms of knots based on indicated airspeed (IAS) in 10 knot increments except that at or above FL 240 speeds may be expressed in terms of mach numbers in .01 increments. The use of mach numbers is restricted to turbojet aircraft with mach meters.

c. Pilots complying with speed adjustments are expected to maintain a speed within plus or minus 10 knots or .02 mach number of the specified speed.

d. Unless pilot concurrence is obtained, ATC requests for speed adjustments will be in accordance with the following minima:

(1) To aircraft operating between FL 280 and 10,000 feet, a speed not less than 250 knots or the equivalent mach number.

(2) To turbine powered aircraft operating below 10,000 feet:

(a) A speed not less than 210 knots, except;

(b) Within 20 flying miles of the airport of intended landing, a speed not less than 170 knots.

(3) Reciprocating engine or turboprop aircraft within 20 flying miles of the runway threshold of the airport of intended landing, a speed not less than 150 knots.

(4) To departing aircraft:

(a) Turbine powered aircraft, a speed not less than 230 knots.

(b) Reciprocating engine aircraft, a speed not less than 150 knots.

e. When ATC combines a speed adjustment with a descent clearance, the sequence of delivery, with the word "then" between, indicates the expected order of execution;

EXAMPLE:

DESCEND AND MAINTAIN (altitude) THEN REDUCE SPEED TO (speed).

EXAMPLE:

REDUCE SPEED TO (speed) THEN DESCEND AND MAINTAIN (altitude).

NOTE.— The maximum speeds below 10,000 feet as established in FAR—91.70 still apply. If there is any doubt concerning the manner in which such a clearance is to be executed, request clarification from ATC.

f. If ATC determines (before an approach clearance is issued) that it is no longer necessary to apply speed adjustment procedures, they will inform the pilot to resume normal speed. Approach clearances supersede any prior speed adjustment assignments and pilots are expected to make their own speed adjustments, as necessary, to complete the approach. Under certain circumstances; however, it may be necessary for ATC to request further speed adjustments after approach clearance is issued to maintain separation between successive arrivals. Under such circumstances previously issued speed adjustments will be restated if that speed is to be maintained or additional speed adjustments are requested. ATC must obtain pilot concurrence for speed adjustments after approach clearances are issued.

g. Controllers have been advised that utilization of the minimum speeds set forth above for reciprocating engine aircraft will sometimes be impractical, since some aircraft in this category cruise at lower speeds and cannot attain the speeds specified. Speed adjustment of reciprocating engine or turbine powered aircraft which cannot attain the minimum speeds set forth shall be accomplished by requesting such flight to, if practical:

(1) Maintain a specified speed equivalent to that of the preceding or succeeding aircraft; or

(2) Increase or decrease speed utilizing increments of 10 knots or multiples thereof.

h. The pilots retain the prerogative of rejecting the application of speed adjustment by ATC if the minimum safe airspeed for any particular operation is greater than the speed adjustment. IN SUCH CASES, PILOTS ARE EXPECTED TO ADVISE ATC OF THE SPEED THAT WILL BE USED.

i. Pilots are reminded that they are responsible for rejecting the application of speed adjustment by ATC if, in their opinion, it will cause them to exceed the maximum indicated airspeed prescribed by FAR—91.70(a). IN SUCH CASES, THE PILOT IS EXPECTED TO SO INFORM ATC. Pilots operating at or above 10,000 feet MSL who are issued speed adjustments which exceed 250 knots IAS and are subsequently cleared below 10,000 feet MSL are expected to comply with FAR—91.70(a).

j. For operations in an airport traffic area, ATC is authorized to request or approve a speed greater than the maximum indicated airspeeds prescribed for operation within that airspace (FAR—91.70(b)).

k. When in communication with the ARTCC, pilots should, as a good operating practice, state any ATC assigned speed restriction on initial radio contact associated with an ATC communications frequency change.

273. RUNWAY SEPARATION

Tower controllers establish the sequence of arriving and departing aircraft by requiring them to adjust flight or ground operation as necessary to achieve proper spacing. They may "HOLD" an aircraft short of the runway to achieve spacing between it and an arriving aircraft; the controller may instruct a pilot to "EXTEND DOWNWIND" in order to establish spacing from an arriving or departing aircraft. At times a clearance may include the word "IMMEDIATE." For example: "CLEARED FOR IMMEDIATE TAKEOFF." In such cases "IMMEDIATE" is used for purposes of *air traffic separation.* It is up to the pilot to refuse the clearance if, in his opinion, compliance would adversely affect his operation. (See PARA—236 - GATE HOLDING DUE TO DEPARTURE DELAYS.)

274. VISUAL SEPARATION

a. Visual separation is a means employed by ATC to separate aircraft only in terminal areas. There are two methods employed to effect this separation:

(1) The tower controller sees the aircraft involved and issues instructions, as necessary, to ensure that the aircraft avoid each other.

(2) A pilot sees the other aircraft involved and upon instructions from the controller provides his own separation by maneuvering his aircraft to avoid it. This may involve following in-trail behind another aircraft or keeping it in sight until it is no longer a factor.

b. A pilot's acceptance of instructions to follow another aircraft or provide visual separation from it is an acknowledgment that the pilot will maneuver his/her aircraft as necessary to avoid the other aircraft or to maintain in-trail separation. In operations conducted behind heavy jet aircraft, it is also an acknowledgment that the pilot accepts the responsibility for wake turbulence separation.

c. WHEN A PILOT HAS BEEN TOLD TO FOLLOW ANOTHER AIRCRAFT OR TO PROVIDE VISUAL SEPARATION FROM IT HE/SHE SHOULD PROMPTLY NOTIFY THE CONTROLLER IF VISUAL CONTACT WITH THE OTHER AIRCRAFT IS LOST OR CANNOT BE MAINTAINED OR IF THE PILOT CANNOT ACCEPT THE RESPONSIBILITY FOR THE SEPARATION FOR ANY REASON.

d. Pilots should remember, however, that they have a regulatory responsibility (FAR 91.67(a)) to see and avoid other aircraft when weather conditions permit.

275. USE OF VISUAL CLEARING PROCEDURES

a. Before Takeoff. Prior to taxiing onto a runway or landing area in preparation for takeoff, pilots should scan the approach areas for possible landing traffic, executing appropriate clearing maneuvers to provide him a clear view of the approach areas.

b. Climbs and Descents. During climbs and descents in flight conditions which permit visual detection of other traffic, pilots should execute gentle banks, left and right at a frequency which permits continuous visual scanning of the airspace about them.

c. Straight and level. Sustained periods of straight and level flight in conditions which permit visual detection of other traffic should be broken at intervals with appropriate clearing procedures to provide effective visual scanning.

d. Traffic pattern. Entries into traffic patterns while descending create specific collision hazards and should be avoided.

e. Traffic at VOR sites. All operators should emphasize the need for sustained vigilance in the vicinity of VORs and airway intersections due to the convergence of traffic.

f. Training operations. Operators of pilot training programs are urged to adopt the following practices:

(1) Pilots undergoing flight instruction at all levels should be requested to verbalize clearing procedures (call out, "clear" left, right, above or below) to instill and sustain the habit of vigilance during maneuvering.

(2) High-wing airplane, momentarily raise the wing in the direction of the intended turn and look.

(3) Low-wing airplane, momentarily lower the wing in the direction of the intended turn and look.

(4) Appropriate clearing procedures should precede the execution of all turns including chandelles, lazy eights, stalls, slow flight, climbs, straight and level, spins and other combination maneuvers.

276—289. RESERVED

Section 5. PREFLIGHT

290. PREFLIGHT PREPARATION

a. Every pilot is urged to receive a preflight briefing and to file a flight plan. This briefing should consist of weather, airport, and en route NAVAID information. Briefing service may be obtained from a FSS either by telephone or interphone, by radio when airborne, or by a personal visit to the station.

b. For your convenience, you are urged to use the Flight Planner which is printed on FAA Form 8740-2. It provides a flight log, a reproduction of FAA Form 7233-1, Flight Plan, blocks to record weather and aeronautical data and a "go or no go" checklist. The Flight Planner and Flight Plan forms are available for use at all flight service stations. Additional copies will be provided on request.

c. Consult an FSS or Weather Service Office (WSO) for preflight weather briefing.

d. FSSs are required to advise of pertinent NOTAMs, but if they are overlooked, don't hesitate to remind the specialist that you have not received NOTAM information.

NOTE.— NOTAMS which are known in sufficient time for publication and are of 7 days duration or longer are normally incorporated into the Notices to Airmen (Class II) publication and carried there until cancellation time. FDC NOTAMs, which apply to instrument flight procedures, are also included in the Notices to Airmen publication up to and including the number indicated in the FDC NOTAM legend. Class II NOTAMs are not provided during a briefing unless specifically requested by the pilot since the FSS specialist has no way of knowing whether the pilot has already checked the Notices to Airmen (Class II) publication prior to calling. Remember to *ask* for Class II NOTAMs in the Notices to Airmen publication. This information is not normally furnished during your briefing. (See PARA—294 - NOTICE TO AIRMEN (NOTAM) SYSTEM.)

e. Pilots are urged to use only the latest issue of aeronautical charts in planning and conducting flight operations. Aeronautical charts are revised and reissued on a regular scheduled basis to ensure that depicted data are current and reliable. In the conterminous U.S., Sectional Charts are updated each 6 months, IFR En route Charts each 56 days, and amendments to civil IFR Approach Charts are accomplished on a 56 day cycle with a change notice volume issued on the 28 day midcycle. Charts that have been superseded by those of a more recent date may contain obsolete or incomplete flight information. (See PARA—623 - GENERAL DESCRIPTION OF EACH CHART SERIES.)

f. When requesting a preflight briefing, identify yourself as a pilot and provide the following:

(1) Type of flight planned, e.g., VFR or IFR.

(2) Aircraft number or pilot's name.

(3) Aircraft type.

(4) Departure Airport.

(5) Route of flight.

(6) Destination.

(7) Flight altitude(s).

(8) ETD and ETE.

g. Calls to air traffic control (ATC) facilities (ARTCCs, Towers, FSSs, Central Flow, and Communications Control Centers) over radio and ATC operational telephone lines (lines used for operational purposes such as controller instructions, briefings, opening and closing flight plans, issuance of IFR clearances and amendments, counter hijacking activities, etc.) may be monitored and recorded for operational uses such as accident investigations, accident prevention, search and rescue purposes, specialist training and evaluation, and technical evaluation and repair of control and communications system.

h. Prior to conducting a briefing, briefers are required to have the background information listed above so that they may tailor the briefing to the needs of the proposed flight. The objective is to communicate a "picture" of meteorological and aeronautical information necessary for the conduct of a safe and efficient flight. Briefers use all available weather and aeronautical information to summarize data applicable to the proposed flight. They do not read weather reports and forecasts verbatim unless specifically requested by the pilot. Refer to PARA—502 for those items of a weather briefing that should be expected or requested.

i. In addition to the filing of a flight plan, if the flight will traverse or land in one or more foreign countries, it is particularly important that pilots leave a complete itinerary with someone directly concerned, keep that person advised of the flight's progress and inform him that, if serious doubt arises as to the safety of the flight, he should first contact the FSS. (See PARA—300 - FLIGHTS OUTSIDE THE UNITED STATES AND U.S. TERRITORIES.)

j. Pilots operating under provisions of FAR—135, and not having an FAA assigned 3-letter designator, are urged to prefix the normal registration (N) number with the letter "T" on flight plan filing, (e.g., TN1234B). (See PARA—193 - AIRCRAFT CALL SIGNS.)

291. FOLLOW IFR PROCEDURES EVEN WHEN OPERATING VFR

a. To maintain IFR proficiency, pilots are urged to practice IFR procedures whenever possible, even when operating VFR. Some suggested practices include:

(1) Obtain a complete preflight and weather briefing. Check the NOTAMS.

(2) File a flight plan. This is an excellent low cost insurance policy. The cost is the time it takes to fill it out. The insurance includes the knowledge that someone will be looking for you if you become overdue at your destination.

(3) Use current charts.

(4) Use the navigation aids. Practice maintaining a good course—keep the needle centered.

(5) Maintain a constant altitude which is appropriate for the direction of flight.

(6) Estimate en route position times.

(7) Make accurate and frequent position reports to the FSSs along your route of flight.

b. Simulated IFR flight is recommended (under the hood); however, pilots are cautioned to review and adhere to the requirements specified in FAR—91.21 before and during such flight.

c. When flying VFR at night, in addition to the altitude appropriate for the direction of flight, pilots should maintain an altitude which is at or above the minimum en route altitude as shown on charts. This is especially true in mountainous terrain, where there is usually very little ground reference. Do not depend on your eyes alone to avoid rising unlighted terrain, or even lighted obstructions such as TV towers.

292—293. RESERVED

294. NOTICE TO AIRMEN (NOTAM) SYSTEM

a. Time-critical aeronautical information which is of either a temporary nature or is not sufficiently known in advance to permit publication on aeronautical charts or in other operational publications, receives immediate dissemination via the National Notice to Airmen (NOTAM) System.

NOTE.— NOTAM information is that aeronautical information that could affect a pilot's decision to make a flight. It includes such information as airport or primary runway closures, changes in the status of navigational aids, ILSs, radar service availability, and other information essential to planned enroute, terminal or landing operations.

b. NOTAM information is classified into three categories. These are NOTAM (D) or distant, NOTAM (L) or local, and Flight Data Center (FDC) NOTAMs.

(1) NOTAM (D)

(a) NOTAM (D) information is disseminated for all navigational facilities that are part of the National Airspace System (NAS), all IFR airports with approved IAPs, and for those VFR airports annotated with the Notam Service Symbol(§) in the Airport/Facility Directory (A/FD). The complete file of all NOTAM (D) information is maintained in a computer data base at the National Communications Center (NATCOM), located in Kansas City. This category of information is distributed automatically, appended to the hourly weather reports, via the Service A telecommunications system. Air traffic facilities, primarily FSS, with Service A capability, have access to the entire NATCOM data base of NOTAMs. These NOTAMs remain available via Service A for the duration of their validity or until published.

(2) NOTAM (L)

(a) NOTAM (L) information includes such data as taxiway closures, men and equipment near or crossing runways, airport rotating beacon outages, and airport lighting aids that do not affect instrument approach criteria, such as VASI. This category of NOTAM also contains all NOTAM information concerning airports that are not annotated with the Notam Service Symbol in the A/FD, including airport and runway closures.

(b) NOTAM (L) information is distributed locally only, and is not attached to the hourly weather reports. A separate file of local NOTAMs is maintained at each FSS, for facilities in their area only. NOTAM (L) information for other FSS areas must be specifically requested directly from the FSS that has responsibility for the airport concerned.

(3) FDC NOTAMS

(a) On those occasions when it becomes necessary to disseminate information which is regulatory in nature, the National Flight Data Center (NFDC), in Washington, D.C., will issue an FDC NOTAM. FDC NOTAMs contain such things as amendments to published IAPs and other current aeronautical charts. They are also used to advertise temporary flight restrictions caused by such things as natural disasters or large scale public events, that may generate a congestion of air traffic over a site.

(b) FDC NOTAMs are transmitted via Service A only once, and are kept on file at the FSS until published or cancelled. FSSs are responsible for maintaining a file of current, unpublished FDC NOTAMs concerning conditions within 400 miles of their facilities. FDC information concering conditions that are more than 400 miles from the FSS, or that is already published, is given to a pilot only on request.

c. An integral part of the NOTAM System is the biweekly Notice to Airmen (Class II) publication. Data is included in this publication to reduce congestion on the telecommunications circuits, and therefore is not available via Service A. This information once published, is not provided during pilot weather briefings unless specifically requested by the pilot.

NOTE.— The term "Class II" refers to the fact that the NOTAMs or notices, appear in printed form for mail distribution as opposed to NOTAMs which are distributed via telecommunications. The latter are considered Class I.

(1) This publication contains two sections:

(a) The first section consists of notices which meet the criteria for NOTAM (D), and are expected to remain in effect for an extended period, and FDC NOTAMs current at the time of publication. Occasionally, some NOTAM (L) and other unique information is included in this section when it will contribute to flight safety.

(b) The second section contains special notices that are too long or concern a wide or unspecified geographic area and are not suitable for inclusion in the first section. The content of these notices vary widely and there are no specific criteria for their inclusion, other than their enhancement of flight safety.

(c) The number of the last FDC NOTAM included in the publication, is noted on the first page to aid the user, in updating the listing contained, with any FDC NOTAMs which may have been issued between the cut-off date and the date the publication is received. All information contained will be carried until the information expires, is cancelled, or in the case of permanent conditions, is published in other publications, such as the A/FD.

(d) All new notices entered, excluding FDC NOTAMs, will be published only if the information is expected to remain in effect for at least 7 days after the effective date of the publication.

295. FLIGHT PLAN — VFR FLIGHTS

a. Except for operations in or penetrating a Coastal or Domestic ADIZ or DEWIZ (See PARA—430 - NATIONAL SECURITY), a flight plan is not required for VFR flight.

However, it is strongly recommended that one be filed with an FAA FSS. This will ensure that you receive VFR Search and Rescue Protection. (Refer to PARA—456.f. for the proper method of filing.)

b. To obtain maximum benefits from the flight plan program, flight plans should be filed directly with the nearest FSS. For your convenience, FSSs provide aeronautical and meteorological briefings while accepting flight plans. Radio may be used to file if no other means are available.

NOTE.— Some states operate aeronautical communications facilities which will accept and forward flight plans to the FSS for further handling.

c. When a "stopover" flight is anticipated, it is recommended that a separate flight plan be filed for each "leg" when the stop is expected to be more than 1 hour duration.

d. Pilots are encouraged to give their departure times directly to the FSS serving the departure airport or as otherwise indicated by the FSS when the flight plan is filed. This will ensure more efficient flight plan service and permit the FSS to advise you of significant changes in aeronautical facilities or meteorological conditions. When a VFR flight plan is filed, it will be held by the FSS until 1 hour after the proposed departure time unless:

(1) The actual departure time is received.

(2) A revised proposed departure time is received.

(3) At a time of filing, the FSS is informed that the proposed departure time will be met, but actual time cannot be given because of inadequate communications (assumed departures).

e. On pilot's request, at a location having an active tower, the aircraft identification will be forwarded by the FSS to the tower for reporting the actual departure time. This procedure should be avoided at busy airports.

f. Although position reports are not required for VFR flight plans, periodic reports to FAA, FSSs along the route are good practice. Such contacts permit significant information to be passed to the transiting aircraft and also serve to check the progress of the flight should it be necessary for any reason to locate the aircraft.

EXAMPLE:

BONANZA 314K, OVER KINGFISHER AT (Time), VFR FLIGHT PLAN, TULSA TO AMARILLO.

EXAMPLE:

CHEROKEE 5133J, OVER OKLAHOMA CITY AT (Time), SHREVEPORT TO DENVER, NO FLIGHT PLAN.

g. Pilots not operating on an IFR flight plan, and when in level cruising flight, are cautioned to conform with VFR cruising altitudes appropriate to direction of flight.

h. Indicate aircraft equipment capabilities when filing VFR flight plans by appending the appropriate suffix to aircraft type in the same manner as that prescribed for IFR flight (see PARA—298 — FLIGHT PLAN - IFR FLIGHTS). Under some circumstances, ATC computer tapes can be useful in constructing the radar history of a downed or crashed aircraft. In each case, knowledge of the aircraft's transponder equipment is necessary in determining whether or not such computer tapes might prove effective.

296. FLIGHT PLAN — DEFENSE VFR (DVFR) FLIGHTS

VFR flights into a Coastal or Domestic ADIZ/DEWIZ are required to file a VFR flight plan for security purposes. Detailed ADIZ procedures are found in the National Security section of this chapter. (See FAR—99.)

297. COMPOSITE FLIGHT PLAN (VFR/IFR FLIGHTS)

a. Flight plans which specify VFR operation for one portion of a flight, and IFR for another portion, will be accepted by the FSS at the point of departure. If VFR flight is conducted for the first portion of the flight, the pilot should report his departure time to the FSS with which he filed his VFR/IFR flight plan; and, subsequently, close the VFR portion and request ATC clearance from the FSS nearest the point at which change from VFR to IFR is proposed. Regardless of the type facility you are communicating with (FSS, center, or tower), it is the pilot's responsibility to request that facility to "CLOSE VFR FLIGHT PLAN." The pilot must remain in VFR weather conditions until operating in accordance with the IFR clearance.

b. When a flight plan indicates IFR for the first portion of flight and VFR for the latter portion, the pilot will normally be cleared to the point at which the change is proposed. Once the pilot has reported over the clearance limit and does not desire further IFR clearance, he should advise ATC to cancel the IFR portion of his flight plan. Then, he should contact the nearest FSS to activate the VFR portion of his flight plan. If the pilot desires to continue his IFR flight plan beyond the clearance limit, he should contact ATC at least 5 minutes prior to the clearance limit and request further IFR clearance. If the requested clearance is not received prior to reaching the clearance limit fix, the pilot will be expected to established himself in a standard holding pattern on the radial or course to the fix unless a holding pattern for the clearance limit fix is depicted on a U.S. Government or commercially produced (meeting FAA requirements) Low or High Altitude En Route, Area or STAR Chart. In this case the pilot will hold according to the depicted pattern.

298. FLIGHT PLAN — IFR FLIGHTS

a. GENERAL

(1) Prior to departure from within, or prior to entering controlled airspace, a pilot must submit a complete flight plan and receive an air traffic clearance, if weather conditions are below VFR minimums. Instrument flight plans may be submitted to the nearest FSSs or ATCT either in person or by telephone (or by radio if no other means are available). Pilots should file IFR flight plans at least 30 minutes prior to estimated time of departure to preclude possible delay in receiving a departure clearance from ATC. To minimize your delay in entering the control zone at destination when IFR weather conditions exist or are forecast at that airport, an IFR flight plan should be filed before departure. Otherwise, a 30 minute delay is not unusual in receiving an ATC clearance because of time spent in processing flight plan data. Traffic saturation frequently prevents control personnel from accepting flight plans by radio. In such cases, the pilot is advised to contact the nearest FSS for the purpose of filing the flight plan.

NOTE.— There are several methods of obtaining IFR clearances at nontower, non-FSSs, and outlying airports. The procedure may vary due to geographical features, weather conditions, and the complexity of the ATC system. To determine the most effective means of receiving an IFR clearance, pilots should ask the nearest FSS the most appropriate means of obtaining the IFR clearance.

(2) When filing an IFR flight plan for a Heavy aircraft, add the prefix H to the aircraft type.

EXAMPLE:

H/DC10/U

(3) When filing an IFR flight plan for flight in an aircraft equipped with a radar beacon transponder, DME equipment, TACAN only equipment or a combination of both, identify equipment capability by adding a suffix to the AIRCRAFT TYPE preceded by a slant, as follows:

/X — no transponder.

/T — transponder with no altitude encoding capability.

/U — transponder with altitude encoding capability.

/D — DME, but no transponder.

/B — DME and transponder, but no altitude encoding capability.

/A — DME and transponder with altitude encoding capability.

/M — TACAN only, but no transponder.

/N — TACAN only and transponder, but with no altitude encoding capability.

/P — TACAN only and transponder with altitude encoding capability.

/C — RNAV and transponder, but with no altitude encoding capability.

/R — RNAV and transponder with altitude encoding capability.

/W — RNAV but no transponder.

(4) It is recommended that pilots file the maximum transponder or navigation capability of their aircraft in the equipment suffix. This will provide ATC with the necessary information to utilize all facets of navigational equipment and transponder capabilities available. In the case of area navigation equipped aircraft, pilots should file the /C, /R, or /W capability of the aircraft even though an RNAV route or random RNAV route has not been requested. This will ensure ATC awareness of the pilot's ability to navigate point-to-point and may be utilized to expedite the flight.

NOTE.— The suffix is not to be added to the aircraft identification or be transmitted by radio as part of the aircraft identification.

b. AIRWAYS/JET ROUTES DEPICTION ON FLIGHT PLAN

(1) It is vitally important that the route of flight be accurately and completely described in the flight plan. To simplify definition of the proposed route, and to facilitate ATC, pilots are requested to file via airways or jet routes established for use at the altitude or flight level planned.

(2) If flight is to be conducted via designated airways or jet routes, describe the route by indicating the type and number designators of the airway(s) or jet route(s) requested. If more than one airway or jet route is to be used, clearly indicate points of transition. If the transition is made at an unnamed intersection, show the next succeeding NAVAID or named intersection on the intended route and the complete route from that point. Reporting points may be identified by using authorized name/code as depicted on appropriate aeronautical charts. The following two examples illustrate the need to specifiy the transition point when two routes share more than one transition fix.

EXAMPLE:

FL 250 ALB J37 BUMPY J14 BHM

SPELLED OUT: Requesting Flight Level 250 from Albany, New York, via Jet Route 37 transitioning to Jet Route 14 at BUMPY intersection, thence via Jet Route 14 to Birmingham, Alabama.

EXAMPLE:

FL 250 ALB J37 ENO J14 BHM

SPELLED OUT: Requesting Flight Level 250 from Albany, New York, via Jet Route 37 transitioning to Jet Route 14 at Kenton VORTAC (ENO) thence via Jet Route 14 to Birmingham, Alabama.

(a) The route of flight may also be described by naming the reporting points or NAVAIDs over which the flight will pass, provided the points named are established for use at the altitude or flight level planned.

EXAMPLE:

30 BWI V44 SWANN V433 DQO

SPELLED OUT: Requesting 3,000 feet from Baltimore-Washington International, via Victor 44 To Swann Intersection, transitioning to Victor 433 at Swann, thence via V433 to Dupont.

(b) When the route of flight is defined by named reporting points, whether alone or in combination with airways or jet routes, and the navigational aids (VOR, VORTAC, TACAN, NDB) to be used for the flight are a combination of different types of aids, enough information should be included to clearly indicate the route requested.

EXAMPLE:

FL 310 LAX J5 LKV J3 GEG YXC FL 330 HL500 VLR HL515 YWG

SPELLED OUT: Requesting FL 310 from Los Angeles International via Jet Route 5 Lakeview, Jet Route 3 Spokane, direct Kimberly, British Columbia Low Frequency Range, Flight Level 330 High Level Airway 500 to Langruth, Manitoba VOR, High Level Airway 515 to Winnepeg, Manitoba.

(c) When filing IFR, it is to the pilot's advantage to file a preferred route.

NOTE.— Preferred IFR routes are described and tabulated in the Airport/Facility Directory.

(d) ATC may issue a SID or a STAR, as appropriate. (See PARA—325 - INSTRUMENT DEPARTURE and PARA—360 - STANDARD TERMINAL ARRIVAL (STAR).)

NOTE.— Pilots not desiring a SID or STAR should so indicate in the remarks section of the flight plan as "NO SID" or "NO STAR".

c. DIRECT FLIGHTS

(1) All or any portions of the route which will not be flown on the radials or courses of established airways or routes, such as direct route flights, must be defined by indicating the radio fixes over which the flight will pass. Fixes selected to define the route shall be those over which the position of the aircraft can be accurately determined. Such fixes automatically become compulsory reporting points for the flight, unless advised otherwise by ATC. Only those navigational aids established for use in a particular structure, i.e., in the low or high structures, may be used to define the en route phase of a direct flight within that altitude structure.

(2) The azimuth feature of VOR aids and that azimuth and distance (DME) features of VORTAC and TACAN aids are assigned certain frequency protected areas of airspace which are intended for application to established airway and route use, and to provide guidance for planning flights outside of established airways or routes. These areas of airspace are expressed in terms of cylindrical service volumes of specified dimensions called "class limits" or "categories." (See PARA—10 - CLASS OF NAVAIDs.) An operational service volume has been established for each class in which adequate signal coverage and frequency protection can be assured. To facilitate use of VOR, VORTAC or TACAN aids, consistent with their operational service volume limits, pilot use of such aids for defining a direct route of flight in controlled airspace should not exceed the following:

(a) Operations above FL 450 — use aids not more than 200 NM apart. These aids are depicted on En Route High Altitude Charts.

(b) Operation off established routes from 18,000 feet MSL to FL 450 - use aids not more than 260 NM apart. These aids are depicted on En Route High Altitude Charts.

(c) Operation off established airways below 18,000 feet MSL — use aids not more than 80 NM apart. These aids are depicted on En Route Low Altitude Charts.

(d) Operation off established airways between 14,500 feet MSL and 17,999 feet MSL in the conterminous U.S. — (H) facilities not more than 200 NM apart may be used.

(3) Increasing use of self-contained airborne navigational systems which do not rely on the VOR/VORTAC/TACAN system has resulted in pilot requests for direct routes which exceed NAVAID service volume limits. These direct route requests will be approved only in a radar environment, with approval based on pilot responsibility for navigation on the authorized direct route. Radar flight following will be provided by ATC for ATC purposes.

(4) At times, ATC will initiate a direct route in a radar environment which exceeds NAVAID service volume limits. In such cases ATC will provide radar monitoring and navigational assistance as necessary.

(5) Airway or jet route numbers, appropriate to the stratum in which operation will be conducted, may also be included to describe portions of the route to be flown.

EXAMPLE:

140 MDW V262 BDF V10 BRL STJ SLN GCK

SPELLED OUT: Requesting 14,000 feet from Chicago Midway Airport via Victor 262 to Bradford, Victor 10 to Burlington, Iowa, direct St. Joseph, Missouri, direct Salina, Kansas, direct Garden City, Kansas.

NOTE.— When route of flight is described by radio fixes, the pilot will be expected to fly a direct course between the points named.

(6) Pilots are reminded that they are responsible for adhering to obstruction clearance requirements on those segments of direct routes that are outside of controlled airspace. The MEA's and other altitudes shown on Low Altitude IFR En Route Charts pertain to those route segments within controlled airspace, and those altitudes may not meet obstruction clearance criteria when operating off those routes.

d. AREA NAVIGATION (RNAV) ROUTES

(1) Except for a few high altitude Alaskan routes, there is no longer a U.S. RNAV route system. Pilots of aircraft equipped with operational area navigation avionics may file for random RNAV routes throughout the National Airspace System where radar monitoring by ATC is available.

(2) The complexities involved in determining route width, with reference to facility usable distance, requires that random RNAV routes only be approved in a radar environment. ATC will radar monitor each flight, however, navigation on the random RNAV route is the responsibility of the pilot. Factors that will be considered by ATC in approving random RNAV routes, include the capability to provide radar monitoring and compatibility with traffic volume and flow.

(3) Pilots requesting ATC clearance for random RNAV routes based on navigational aids are expected to do the following:

(a) File airport to airport flight plans prior to departure.

(b) File the appropriate RNAV capability certification suffix in the flight plan.

(c) Plan the random route portion of the flight plan to begin and end over appropriate arrival and departure transition fixes or appropriate navigation aids for the altitude stratum within which the flight will be conducted.

(d) File route structure transitions to and from the random route portion in the flight plan. The use of normal preferred departure and arrival routes, such as SID and STAR where established, is recommended.

(e) Define random routes by waypoints. File route description waypoints by using degree-distance in reference to navigation aids for the appropriate altitude stratum.

(f) File a minimum of one route description waypoint for each ARTCC's area over which the random portion of flight will be conducted. Such waypoints must be located within 200 NM of the boundary of the preceding centers flight advisory area.

(g) File an additional route description waypoint for each turnpoint in the route.

(h) Though not required in the flight plan, plan additional waypoints necessary to ensure accurate navigation via the filed route of flight. Navigation is the pilot's responsibility unless ATC assistance is requested.

(i) Plan the route of flight so as to avoid Prohibited and Restricted Airspace unless pilots have obtained permission to operate in that airspace and so informs the appropriate ATC facility. Avoid flight planning through other uncontrolled airspace unless specifically desiring flight through such airspace.

(4) Pilots requesting ATC clearance for random RNAV routes based on latitude/longitude coordinates are expected to do the following:

(a) File airport to airport flight plans prior to departure.

(b) File the appropriate RNAV capability certification suffix in the flight plan.

(c) Plan the random route portion of the flight to begin and end over published departure/arrival transition fixes or appropriate navigation aids for airports without published transition procedures. The use of preferred departure and arrival routes, such as SID and STAR where established, is recommended.

(d) Plan the route of flight so as to avoid prohibited and restricted airspace by 3 NM unless permission has been obtained to operate in that airspace and the appropriate ATC facility is advised.

(e) Define the route of flight after the departure fix, including each intermediate fix (turnpoint) and the arrival fix for the destination airport in terms of latitude/longitude coordinates plotted to the nearest minute. The arrival fix must be identified by both the latitude/longitude coordinates and a fix identifier.

Example:

MIA [1] SRQ [2] 3407/10615 [3] 3407/11546 TNP [4] LAX [5]

1. Departure airport.
2. Departure fix.
3. Intermediate fix (turning point).
4. Arrival fix.
5. Destination airport.

(f) Record latitude/longitude coordinates by four figures describing latitude in degrees and minutes followed by a solidus and five figures describing longitude in degrees and minutes.

(g) File at FL 390 or above for the random RNAV portion of the flight.

(h) Fly all routes/route segments on Great Circle tracks.

(i) Make any inflight requests for random RNAV clearances or route amendments to an en route ATC facility.

(5) To be certified for use in the National Airspace System, RNAV equipment must meet the specifications outline in AC 90-45. The pilot is responsible for variations in equipment capability, and must advise ATC if he cannot accept an RNAV clearance as specified. The controller need only be concerned that the aircraft is RNAV equipped. If the flight plan equipment suffix denotes RNAV capability, then RNAV routing can be applied.

299. IFR OPERATIONS TO HIGH ALTITUDE DESTINATIONS

a. Pilots planning IFR flights to airports located in mountainous terrain are cautioned to consider the necessity for an alternate airport even when the forecast weather conditions would technically relieve them from the requirement to file one (Reference: FAR—91.23(b)). The FAA has identified three possible situations where the failure to plan for an alternate airport when flying IFR to such a destination airport could result in a critical situation if the weather is less than forecast and sufficient fuel is not available to proceed to a suitable airport.

(1) An IFR flight to an airport where the MDAs or landing visibility minimums for *ALL INSTRUMENT APPROACHES* are higher than the forecast weather minimums specified in FAR—91.23(b). For example, there are 10 high altitude airports in the United States with approved instrument approach procedures where all of the Minimum Descent Altitudes (MDAs) are greater than 2000 feet and/or the landing visibility minimums are greater than 3 miles (Bishop, California; South Lake Tahoe, California; Ukiah, California; Butte, Montana; Helena, Montana; Missoula, Montana; Chadron, Nebraska; Ely, Nevada; Klamath Falls, Oregon; and Omak, Washington). In the case of these 10 airports, it is possible for a pilot to elect, on the basis of forecasts, not to carry sufficient fuel to get to an alternate when the ceiling and/or visibility is actually lower than that necessary to complete the approach.

(2) A small number of other airports in mountainous terrain have MDAs which are slightly (100 to 300 feet) below 2000 feet AGL. In situations where there is an option as to whether to plan for an alternate, pilots should bear in mind that just a slight worsening of the weather conditions from those forecast could place the airport below the published IFR landing minimums.

(3) An IFR flight to an airport which requires special equipment, i.e., DME, glide slope, etc., in order to make the available approaches to the lowest minimums. Pilots should be aware that all other minimums on the approach charts may require weather conditions better than those specified in FAR—91.23(b). An inflight equipment malfunction could result in the inability to comply with the published approach procedures or, again, in the position of having the airport below the published IFR landing minimums for all remaining instrument approach alternatives.

300. FLIGHTS OUTSIDE THE UNITED STATES AND U.S. TERRITORIES

a. When conducting flights, particularly extended flights, outside the U.S. and its territories, full account should be taken of the amount and quality of air navigation services available in the airspace to be traversed. Every effort should be made to secure information on the location and range of navigational aids, availability of communications and meterological services, the provision of air traffic services, including alerting service, and the existence of search and rescue services.

b. Pilots should remember that there is a need to continuously guard the VHF emergency frequency 121.5 MHz when on long over-water flights, except when communications on other VHF channels, equipment limitations, or cockpit duties prevent simultaneous guarding of two channels. Guarding of 121.5 MHz is particularly critical when operating in proximity to flight information region (FIR) boundaries, for example, operations on Route R220 between Anchorage and Tokyo, since it serves to facilitate communications with regard to aircraft which may experience in-flight emergencies, communications, or navigational difficulities. (Reference ICAO Annex 10, Vol II Paras 5.2.2.1.1.1 and 5.2.2.1.1.2.)

c. The filing of a flight plan, always good practice, takes on added significance for extended flights outside U.S. airspace and is, in fact, usually required by the laws of the countries being visited or overflown. It is also particularly important in the case of such flights that pilots leave a complete itinerary and schedule of the flight with someone directly concerned, keep that person advised of the flight's progress and inform him that if serious doubt arises as to the safety of the flight he should first contact the appropriate FSS.

d. All pilots should review the foreign airspace and entry restrictions published in the IFIM during the flight planning process. Foreign airspace penetration without official authorization can involve both danger to the aircraft and the imposition of severe penalties and inconvenience to both passengers and crew. A flight plan on file with ATC authorities does not necessarily constitute the prior permission required by certain other authorities. The possibility of fatal consequences cannot be ignored in some areas of the world.

e. Current NOTAMs for foreign locations must also be reviewed. The publication International Notices to Airmen, published biweekly, contains considerable information pertinent to foreign flight. Current foreign NOTAMs are also available from the U.S. International NOTAM Office in Washington, D.C., through any local FSS.

f. When customs notification is required, it is the responsibility of the pilot to arrange for customs notification in a timely manner. The following guidelines are applicable:

(1) When customs notification is required on flights to Canada and Mexico and a predeparture flight plan cannot be filed or an advise customs message (ADCUS) cannot be included in a predeparture flight plan, call the nearest en route domestic or International FSS as soon as radio communication can be established and file a VFR or DVFR flight plan, as required, and include as the last item the advise customs information. The station with which such a flight plan is filed will forward it to the appropriate FSS who will notify the customs office responsible for the destination airport.

(2) If the pilot fails to include ADCUS in the radioed flight plan, it will be assumed that other arrangements have been made and FAA will not advise customs.

(3) The FAA assumes no responsibility for any delays in advising customs if the flight plan is given too late for delivery to customs before arrival of the aircraft. It is still the pilot's responsibility to give timely notice even though a flight plan is given to FAA.

301. CHANGE IN FLIGHT PLAN

In addition to altitude or flight level, destination and/or route changes, increasing or decreasing the speed of an aircraft constitutes a change in a flight plan. Therefore, at any time the average true airspeed at cruising altitude between reporting points varies or is expected to vary from that given in the flight plan by *plus or minus 5 percent, or 10 knots, whichever is greater,* ATC should be advised.

302. CHANGE IN PROPOSED DEPARTURE TIME

a. To prevent computer saturation in the en route environment, parameters have been established to delete proposed departure flight plans which have not been activated. Most centers have this parameter set so as to delete these flight plans a minimum of 1 hour after the proposed departure time. To ensure that a flight plan remains active, pilots whose actual departure time will be delayed 1 hour or more beyond their filed departure time, are requested to notify ATC of their departure time.

b. Due to traffic saturation, control personnel frequently will be unable to accept these revisions via radio. It is recommended that you forward these revisions to the nearest FSS.

303. CLOSING VFR/DVFR FLIGHT PLANS

A pilot is responsible for ensuring that his VFR or DVFR flight plan is cancelled (FAR—91.83). You should close your flight plan with the nearest FSS, or if one is not available, you may request any ATC facility to relay your cancellation to the FSS. *Control towers do not automatically close VFR or DVFR flight plans* since they do not know if a particular VFR aircraft is on a flight plan. If you fail to report or cancel your flight plan within 1/2 hour after your ETA, Search and Rescue procedures are started.

304. CANCELLING IFR FLIGHT PLAN

a. FAR—91.83 includes the statement "When a flight plan has been filed, the pilot in command, upon cancelling or completing the flight under the flight plan, shall notify the nearest FSS or ATC facility."

b. An IFR flight plan may be cancelled at any time the flight is operating in VFR conditions outside positive controlled airspace by the pilot stating "CANCEL MY IFR FLIGHT PLAN" to the controller or air/ground station with which he is communicating. Immediately after cancelling an IFR flight plan, a pilot should take necessary action to change to the appropriate air/ground frequency, VFR radar beacon code and VFR altitude or flight level.

c. ATC separation and information services will be discontinued, including radar services (where applicable). Consequently, if the cancelling flight desires VFR radar advisory service, the pilot must specifically request it.

NOTE.— Pilots must be aware that other procedures may be applicable to a flight that cancels an IFR flight plan within an area where a special program has been established such as a designated TRSA or TCA.

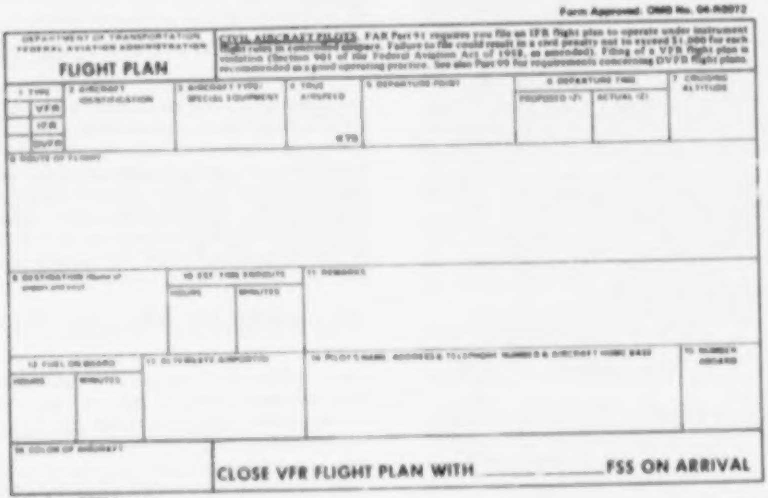
d. If a DVFR flight plan requirement exists, the pilot is responsible for filing this flight plan to replace the cancelled IFR flight plan. If a subsequent IFR operation becomes necessary, a new IFR flight plan must be filed and an ATC clearance obtained before operating in IFR conditions.

e. If operating on an IFR flight plan to an airport with a functioning control tower, the flight plan is automatically closed upon landing.

f. If operating on an IFR flight plan to an airport where there is no functioning control tower, the pilot must initiate cancellation of the IFR flight plan. This can be done after landing if there is a functioning FSS or other means of direct communications with ATC. In the event there is no FSS and air/ground communications with ATC is not possible below a certain altitude, the pilot should, weather conditions permitting, cancel his IFR flight plan while still airborne and able to communicate with ATC by radio. This will not only save the time and expense of cancelling the flight plan by telephone but will quickly release the airspace for use by other aircraft.

305. GENERAL INSTRUCTIONS FOR THE FAA FLIGHT PLAN FORM

a. Flight Plan Form.



Form Approved: OMB No. 04-R0072

FLIGHT PLAN

VFR

IFR

DVFR

KTS

CLOSE VFR FLIGHT PLAN WITH ______ ______FSS ON ARRIVAL

FAA Form 7233-1

b. Explanation of Flight Plan Items.

Block 1. Check the type flight plan. Check both the VFR and IFR blocks if composite VFR/IFR.

Block 2. Enter your complete aircraft identification including the prefix "N" if applicable.

Block 3. Enter the designator for the aircraft or, if unknown, the aircraft manufacturer's name (e.g., Cessna); followed by a slant(/) and the transponder or DME equipment code letter (e.g., C-182/U).

Block 4. Enter your computed true airspeed (TAS).

NOTE.— If IFR and the average TAS changes plus or minus 5 percent or 10 knots, whichever is greater, advise ATC.

Block 5. Enter the departure airport identifier code (or the name if identifier is unknown).

NOTE.— Use of identifier codes will expedite the processing of your flight plan.

Block 6. Enter the proposed departure time in Coordinated Universal Time (UTC) (Z). If airborne, specify the actual or proposed departure time as appropriate.

Block 7. If VFR, enter the appropriate VFR altitude (to assist the briefer in providing weather and wind information) and, if IFR, enter the requested en route altitude or flight level.

NOTE.— Enter only the initial requested altitude in this block. When more than one IFR altitude or flight level is desired along the route of flight, it is best to make a subsequent request direct to the controller.

Block 8. Define the route of flight by using NAVAID identifier codes (or names if the code is unknown), airways, jet routes, and waypoints (for RNAV).

NOTE.— Use NAVAIDs or WAYPOINTs to define direct routes and radials/bearings to define other unpublished routes.

Block 9. Enter the destination airport identifier code (or name if identifier is unknown).

NOTE.— Include the city name (or even the state name) if needed for clarity.

Block 10. Enter your estimated time en route based on latest forecast winds.

Block 11. Enter only those remarks pertinent to ATC or to the clarification of other flight plan information such as the appropriate radiotelephony (call sign) associated with the designator filed in Block 2. Items of a personal nature are not accepted. Do not assume that remarks will be automatically transmitted to every controller. Specific ATC or en route requests should be made directly to the appropriate controller.

Block 12. Specify the fuel on board computed from the departure point.

Block 13. Specify an alternate airport if desired or required, but do not include routing to the alternate airport.

Block 14. Enter your complete name, address, and telephone number. Enter sufficient information to identify home base, airport, or operator.

NOTE.— This information would be essential in the event of search and rescue operation.

Block 15. Enter the total number of persons on board including crew.

Block 16. Enter the predominant colors.

Last Block. For VFR flight plans, record the FSS name for closing the flight plan. If the flight plan is closed with a different FSS or facility, state the recorded FSS name that would normally have closed your flight plan.

NOTE.— Close IFR flight plans with tower, approach control, or ARTCCs, or if unable, with FSS. When landing at an airport with a functioning control tower, IFR flight plans are automatically cancelled.

c. The information transmitted to the destination FSS for VFR Flight Plans will consist only of flight plans blocks 2,3,9, and 10. Estimated time en route (ETE) will be converted to the correct estimated time of arrival (ETA) for VFR flight plans.

d. The information transmitted to the ARTCC for IFR Flight Plans will consist of only flight plan blocks 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11.

e. A description of the International Flight Plan Form is contained in the International Flight Information Manual.

306—319. RESERVED

NOTES

Section 6. DEPARTURE PROCEDURES

320. PRE-TAXI CLEARANCE PROCEDURES

a. Certain airports have established Pre-taxi Clearance programs whereby pilots of departing IFR aircraft may elect to receive their IFR clearances before they start taxiing for takeoff. The following provisions are included in such procedures:

(1) Pilot participation is not mandatory.

(2) Participating pilots call clearance delivery or ground control not more than 10 minutes before proposed taxi time.

(3) IFR clearance (or delay information, if clearance cannot be obtained) is issued at the time of this initial call-up.

(4) When the IFR clearance is received on clearance delivery frequency, pilots call ground control when ready to taxi.

(5) Normally, pilots need not inform ground control that they have received IFR clearance on clearance delivery frequency. Certain locations may, however, require that the pilot inform ground control of a portion of his routing or that he has received his IFR clearance.

(6) If a pilot cannot establish contact on clearance delivery frequency or has not received his IFR clearance before he is ready to taxi, he contacts ground control and informs the controller accordingly.

b. Locations where these procedures are in effect are indicated in the Airport/Facility Directory.

321. TAXI CLEARANCE

Pilots on IFR flight plans should communicate with the control tower on the appropriate ground control or clearance delivery frequency, prior to starting engines, to receive engine start time, taxi and/or clearance information.

322. ABBREVIATED IFR DEPARTURE CLEARANCE (CLEARED...AS FILED) PROCEDURES

a. ATC facilities will issue an abbreviated IFR departure clearance based on the ROUTE of flight filed in the IFR flight plan, provided the filed route can be approved with little or no revision. These abbreviated clearance procedures are based on the following conditions:

(1) The aircraft is on the ground or it has departed VFR and the pilot is requesting IFR clearance while airborne.

(2) That a pilot will not accept an abbreviated clearance if the route or destination of a flight plan filed with ATC has been changed by him or the company or the operations officer before departure.

(3) That it is the responsibility of the company or operations office to inform the pilot when they make a change to the filed flight plan.

(4) That it is the responsibility of the pilot to inform ATC in his initial call-up (for clearance) when the filed flight plan has been either:

(a) amended, or

(b) cancelled and replaced with a new filed flight plan.

NOTE.— The facility issuing a clearance may not have received the revised route or the revised flight plan by the time a pilot requests clearance.

b. The controller will issue a detailed clearance when he knows that the original filed flight plan has been changed or when the pilot requests a full route clearance.

c. The clearance as issued will include the destination airport filed in the flight plan.

d. ATC procedures now require the controller to state the SID name, the current number and the SID Transition name after the phrase "Cleared to (destination) airport" and prior to the phrase, "then as filed," for ALL departure clearances when the SID or SID Transition is to be flown. The procedures apply whether or not the SID is filed in the flight plan.

e. STARs, when filed in a flight plan, are considered a part of the filed route of flight and will not normally be stated in an initial departure clearance. If the ARTCC's jurisdictional airspace includes both the departure airport and the fix where a STAR or STAR Transition begins, the STAR name, the current number and the STAR Transition name MAY be stated in the initial clearance.

f. "Cleared to (destination) airport as filed" does NOT include the en route altitude filed in a flight plan. An en route altitude will be stated in the clearance or the pilot will be advised to expect an assigned or filed altitude within a given time frame or at a certain point after departure. This may be done verbally in the departure instructions or stated in the SID.

g. In both radar and nonradar environments, the controller will state "Cleared to (destination) airport as filed" or:

(1) If a SID or SID Transition is to be flown, specify the SID name, the current SID number, the SID Transition name, the assigned altitude/flight level, and any additional instructions (departure control frequency, beacon code assignment, etc.) necessary to clear a departing aircraft via the SID or SID Transition and the route filed.

EXAMPLE:

NATIONAL SEVEN TWENTY CLEARED TO MIAMI AIRPORT INTERCONTINENTAL ONE DEPARTURE, LAKE CHARLES TRANSITION THEN AS FILED, MAINTAIN FLIGHT LEVEL TWO SEVEN ZERO.

(2) When there is no SID or when the pilot cannot accept a SID, the controller will specify the assigned altitude or flight level, and any additional instructions necessary to clear a departing aircraft via an appropriate departure routing and the route filed.

NOTE.— A detailed departure route description or a radar vector may be used to achieve the desired departure routing.

(3) If it is necessary to make a minor revision to the filed route, the controller will specify the assigned SID or SID Transition (or departure routing), the revision to the filed route, the assigned altitude or flight level and any additional instructions necessary to clear a departing aircraft.

EXAMPLE:

JET STAR ONE FOUR TWO FOUR CLEARED TO ATLANTA AIRPORT, SOUTH BOSTON TWO DEPARTURE THEN AS FILED EXCEPT CHANGE ROUTE TO READ SOUTH BOSTON VICTOR 20 GREENSBORO, MAINTAIN ONE SEVEN THOUSAND.

(4) Additionally, in a nonradar environment, the controller will specify one or more fixes, as necessary, to identify the initial route of flight.

EXAMPLE:

CESSNA THREE ONE SIX ZERO FOXTROT CLEARED TO CHARLOTTE AIRPORT AS FILED VIA BROOKE, MAINTAIN SEVEN THOUSAND.

h. To ensure success of the program, pilots should:

(1) Avoid making changes to a filed flight plan just prior to departure.

(2) State the following information in the initial call-up to the facility when no change has been made to the filed flight plan: Aircraft call sign, location, type operation (IFR) and the name of the airport (or fix) to which you expect clearance.

EXAMPLE:

"WASHINGTON CLEARANCE DELIVERY (or ground control if appropriate) AMERICAN SEVENTY SIX AT GATE ONE, IFR LOS ANGELES."

(3) If the flight plan has been changed, state the change and request a full route clearance.

EXAMPLE:

"WASHINGTON CLEARANCE DELIVERY, AMERICAN SEVENTY SIX AT GATE ONE. IFR SAN FRANCISCO. MY FLIGHT PLAN ROUTE HAS BEEN AMENDED (or destination changed). REQUEST FULL ROUTE CLEARANCE."

(4) Request verification or clarification from ATC if ANY portion of the clearance is not clearly understood.

(5) When requesting clearance for the IFR portion of a VFR/IFR flight, request such clearance prior to the fix where IFR operation is proposed to commence in sufficient time to avoid delay. Use the following phraseology:

EXAMPLE:

"LOS ANGELES CENTER, APACHE SIX ONE PAPA, VFR ESTIMATING PASO ROBLES VOR AT THREE TWO, ONE THOUSAND FIVE HUNDRED, REQUEST IFR TO BAKERSFIELD."

323. DEPARTURE RESTRICTIONS, CLEARANCE VOID TIMES, HOLD FOR RELEASE, AND RELEASE TIMES

a. ATC may assign departure restrictions, clearance void times, hold for release, and release times, when necessary, to separate departures from other traffic or to restrict or regulate the departure flow.

(1) CLEARANCE VOID TIMES — If operating from an airport not served by a control tower, the pilot may receive a clearance containing a provision that if the flight has not departed by a specific time, the clearance is void. In this situation, the pilot who does not depart prior to the void time must advise ATC as soon as possible, but no later than 30 minutes, of his intentions. Failure to take this action can result in costly delays and reroutes of other IFR traffic because ATC will take action on the assumption that the pilot departed as cleared. Additionally, extensive search and rescue operations may be initiated if nothing is heard from the pilot after he accepts the ATC clearance.

EXAMPLE:

CLEARANCE VOID IF NOT OFF BY (clearance void time) and, if required, IF NOT OFF BY (clearance void time) ADVISE (facility) NOT LATER THAN (time) OF INTENTIONS.

(2) HOLD FOR RELEASE — ATC may issue "hold for release" instructions in a clearance to delay an aircraft's departure for traffic management reasons (i.e., weather, traffic volume, etc.). When ATC states in the clearance, "hold for release," the pilot may not depart until he receives a release time or is given additional instructions by ATC. In addition, ATC will include departure delay information in conjunction with "hold for release" instructions.

EXAMPLE:

(aircraft identification) CLEARED TO (destination) AIRPORT AS FILED, MAINTAIN (altitude), and, if required (additional instructions or information), HOLD FOR RELEASE, EXPECT (time in hours and/or minutes) DEPARTURE DELAY.

(3) RELEASE TIMES — A "release time" is a departure restriction issued to a pilot by ATC, specifying the earliest time an aircraft may depart. ATC will use "release times" in conjunction with traffic management procedures and/or to separate a departing aircraft from other traffic.

EXAMPLE:

(aircraft identification) RELEASED FOR DEPARTURE AT (time in hours and/or minutes).

324. DEPARTURE CONTROL

a. Departure Control is an approach control function responsible for ensuring separation between departures. So as to expedite the handling of departures, Departure Control may suggest a take off direction other than that which may normally have been used under VFR handling. Many times it is preferred to offer the pilot a runway that will require the fewest turns after take off to place the pilot on his filed course or selected departure route as quickly as possible. At many locations particular attention is paid to the use of preferential runways for local noise abatement programs, and route departures away from congested areas.

b. Departure Control utilizing radar will normally clear aircraft out of the terminal area using SIDs via radio navigation aids. When a departure is to be vectored immediately following take off, the pilot will be advised prior to take off of the initial heading to be flown but may not be advised of the purpose of the heading. Pilots operating in a radar environment are expected to associate departure headings with vectors to their planned route or flight. When given a vector taking his aircraft off a previously assigned nonradar route, the pilot will be advised briefly what the vector is to achieve. Thereafter, radar service will be provided until the aircraft has been reestablished "oncourse" using an appropriate navigation aid and the pilot has been advised of his position or a handoff is made to another radar controller with further surveillance capabilities.

c. Controllers will inform pilots of the departure control frequencies and, if appropriate, the transponder code before takeoff. Pilots should not operate their transponder until ready to start the takeoff roll or change to the departure control frequency until requested. Controllers may omit the departure control frequency if a SID has or will be assigned and the departure control frequency is published on the SID.

325. INSTRUMENT DEPARTURES

a. STANDARD INSTRUMENT DEPARTURES (SID)

(1) A SID is an ATC coded departure procedure which has been established at certain airports to simplify clearance delivery procedures.

(2) Pilots of civil aircraft operating from locations where SID procedures are effective may expect ATC clearances containing a SID. Use of a SID requires pilot possession of at least the textual description of the SID procedures. Controllers may omit the departure control frequency if a SID clearance is issued and the departure control frequency is published on the SID. If the pilot does not possess a charted SID or a preprinted SID description or, for any other reason, does not wish to use a SID, he is expected to advise ATC. Notification may be accomplished by filing "NO SID" in the remarks section of the filed flight plan or by the less desirable method of verbally advising ATC.

(3) All effective SIDs are published in textual and graphic form by the National Ocean Service in East and West SID booklets.

(4) SID procedures will be depicted in one of two basic forms.

(a) Pilot Navigation (Pilot NAV) SIDs: are established where the pilot is primarily responsible for navigation on the SID route. They are established for airports when terrain and safety related factors indicate the necessity for a pilot NAV SID. Some pilot NAV SIDs may contain vector instructions which pilots are expected to comply with until instruction are received to resume normal navigation on the filed/assigned route or SID procedure.

(b) Vector SIDs: are established where ATC will provide radar navigational guidance to a filed/assigned route or to a fix depicted on the SID.

b. OBSTRUCTION CLEARANCE DURING DEPARTURE

(1) Published instrument departure procedures and SIDs assist pilots conducting IFR flight in avoiding obstacles during climbout to minimum en route altitude (MEA). Standard instrument takeoff minimums and departure procedures are prescribed in FAR 91.116(f). Airports with takeoff minimums other than standard (one statute mile for aircraft having two engines or less and one-half statute mile for aircraft having more than two engines) are described in airport listings on separate pages, titled IFR TAKE-OFF MINIMUMS AND DEPARTURE PROCEDURES, at the front of each IAP book. The approach chart and SID chart for each airport with nonstandard takeoff minimums is annotated with a special symbol▼T. The use of this symbol indicates that the separate listing should be consulted. These minimums also apply to SIDs unless the SIDs specify different minimums.

(2) Obstacle clearance is based on the aircraft climbing at 200 feet per nautical mile, crossing the end of the runway at 35 feet AGL, and climbing to 400 feet above airport elevation before turning unless otherwise specified in the procedure. A slope of 152 feet per mile, starting no higher than 35 feet above the departure end of the runway, is assessed for obstacles. A minimum of 48 feet of obstacle clearance is provided for each mile of flight.

(a) If no obstacles penetrate the 152 feet per mile slope, IFR departure procedures are not published.

(b) If obstacles penetrate the slope, obstacle avoidance procedures are specified. These procedures may be: a ceiling and visibility to allow the obstacles to be seen and avoided; a climb gradient greater than 200 feet per mile; detailed flight maneuvers; or a combination of the above. In extreme cases, IFR takeoff may not be authorized for some runways.

EXAMPLE:

Rwy 17, 300-1 or standard with minimum climb of 220 feet per NM to 1100.

(3) Climb gradients are specified when required for obstacle clearance. Crossing restrictions in the SIDs may be established for traffic separation or obstacle clearance. When no gradient is specified, the pilot is expected to climb at least 200 feet per mile to MEA unless required to level off by a crossing restriction.

EXAMPLE:

"CROSS ALPHA INTERSECTION AT OR BELOW 4000; MAINTAIN 6000." The pilot climbs at least 200 feet per mile to 6000. If 4000 is reached before ALPHA, the pilot levels off at 4000 until passing ALPHA; then immediately resumes at least 200 feet per mile climb.

(4) Climb gradients may be specified to an altitude/fix, above which the normal gradient applies.

EXAMPLE:

"MINIMUM CLIMB 340 FEET PER NM TO 2700." The pilot climbs at least 340 feet per mile to 2700, then at least 200 feet per mile to MEA.

(5) Some procedures require a climb in visual conditions to cross the airport (or an on-airport NAVAID) at or above an altitude.

EXAMPLE:

"CLIMB VISUALLY TO CROSS THE AIRPORT AT OR ABOVE 8800, THEN CLIMB VIA R-293 TO ABC VOR."

(a) The specified ceiling and visibility minimums will be enough to allow the pilot to see and avoid obstacles near the airport. Obstacle avoidance is not guaranteed if the pilot maneuvers farther from the airport than the visibility minimum.

(b) That segment of the procedure which requires the pilot to see and avoid obstacles ends when the aircraft crosses the specified point at the required altitude. Thereafter, standard obstacle protection is provided.

(6) Each pilot, prior to departing an airport on an IFR flight should consider the type of terrain and other obstacles on or in the vicinity of the departure airport and:

(a) Determine whether a departure procedure and/or SID is available for obstacle avoidance.

(b) Determine if obstacle avoidance can be maintained visually or that the departure procedure or SID should be followed.

(c) Determine what action will be necessary and take such action that will assure a safe departure.

326—339. RESERVED

Section 7. EN ROUTE PROCEDURES

340. ARTCC COMMUNICATIONS

a. DIRECT COMMUNICATIONS — CONTROLLERS AND PILOTS

(1) ARTCCs are capable of direct communications with IFR air traffic on certain frequencies. Maximum communications coverage is possible through the use of Remote Center Air/Ground (RCAG) sites comprised of both VHF and UHF transmitters and receivers. These sites are located throughout the U.S.. Although they may be several hundred miles away from the ARTCC, they are remoted to the various ARTCCs by land lines or microwave links. Since IFR operations are expedited through the use of direct communications, pilots are requested to use these frequencies strictly for communications pertinent to the control of IFR aircraft. Flight plan filing, en route weather, weather forecasts and similar data should be requested through FSSs, company radio, or appropriate military facilities capable of performing these services.

(2) An ARTCC is divided into sectors. Each sector is handled by one or a team of controllers and has its own sector discrete frequency. As a flight progresses from one sector to another, the pilot is requested to change to the appropriate sector discrete frequency.

(3) ATC Frequency Change Procedures:

(a) The following phraseology will be used by controllers to effect a frequency change:

EXAMPLE:

(Aircraft Identification) CONTACT (facility name or location name and terminal function) (frequency) AT (time, fix or altitude).

NOTE.— Pilots are expected to maintain a listening watch on the transferring controller's frequency until the time, fix or altitude specified. ATC will omit frequency change restrictions whenever pilot compliance is expected upon receipt.

(b) The following phraseology should be utilized by pilots for establishing contact with the designated facility:

1. When a position report will be made:

EXAMPLE:

(Name) CENTER, (aircraft identification), (position).

2. When no position report will be made:

EXAMPLE:

(Name) CENTER, (aircraft identification), ESTIMATING (reporting point and time) AT (altitude or flight level) CLIMBING (or descending) TO MAINTAIN (altitude or flight level).

3. When operating in a radar environment and no position report is required:

EXAMPLE:

(Name) CENTER, (aircraft identification) AT (exact altitude or flight level); or, if appropriate,

EXAMPLE:

LEAVING (exact altitude or flight level) CLIMBING (or descending) TO MAINTAIN (altitude or flight level).

NOTE.— Exact altitude or flight level means to the nearest 100 foot increment. Exact altitude or flight level reports on initial contact provide ATC with information required prior to using MODE C altitude information for separation purposes.

(c) At times controllers will ask pilots to verify that they are at a particular altitude. The phraseology used will be: "VERIFY AT (altitude)." In climbing or descending situations, controllers may ask pilots to "VERIFY ASSIGNED ALTITUDE AS (altitude)." Pilots should confirm that they are at the altitude stated by the controller or that the assigned altitude is correct as stated. If this is not the case, they should inform the controller of the actual altitude being maintained or the different assigned altitude.

CAUTION: Pilots should not take action to change their actual altitude or different assigned altitude to the altitude stated in the controllers verification request unless the controller specifically authorizes a change.

(4) ARTCC Radio Frequency Outage:

(a) ARTCCs normally have at least one back up radio receiver and transmitter system for each frequency which can usually be placed into service quickly with little or no disruption of ATC service. Occasionally, technical problems may cause a delay but switchover seldom takes more than 60 seconds. When it appears that the outage will not be quickly remedied, the ARTCC will usually request a nearby aircraft, if there is one, to switch to the affected frequency to broadcast communications instructions. It is important, therefore, that the pilot wait at least 1 minute before deciding that the ARTCC has actually experienced a radio frequency failure. When such an outage does occur, the pilot should, if workload and equipment capability permit, maintain a listening watch on the affected frequency while attempting to comply with the following recommended communications procedures:

1. If two-way communications cannot be established with the ARTCC after changing frequencies, a pilot should attempt to recontact the transferring controller for the assignment of an alternative frequency or other instructions.

2. When an ARTCC radio frequency failure occurs after two-way communications have been established, the pilot should attempt to reestablish contact with the center on any other known ARTCC frequency, preferably that of the next responsible sector when practicable, and ask for instructions. However, when the next normal frequency change along the route is known to involve another ATC facility, the pilot should contact that facility, if feasible, for instructions. If communications cannot be reestablished by either method, the pilot is expected to request communications instructions from the FSS appropriate to the route of flight.

NOTE.— The exchange of information between an aircraft and an ARTCC through an FSS is quicker than relay via company radio because the FSS has direct interphone lines to the responsible ARTCC sector. Accordingly, when circumstances dictate a

choice between the two, during an ARTCC frequency outage, relay via FSS radio is recommended.

341. POSITION REPORTING

The safety and effectiveness of traffic control depends to a large extent on accurate position reporting. In order to provide the proper separation and expedite aircraft movements, ATC must be able to make accurate estimates of the progress of every aircraft operating on an IFR flight plan.

a. POSITION IDENTIFICATION

(1) When a position report is to be made passing a VOR radio facility, the time reported should be the time at which the first complete reversal of the "to/from" indicator is accomplished.

(2) When a position report is made passing a facility by means of an airborne ADF, the time reported should be the time at which the indicator makes a complete reversal.

(3) When an aural or a light panel indication is used to determine the time passing a reporting point, such as a fan marker, Z marker, cone of silence or intersection of range courses, the time should be noted when the signal is first received and again when it ceases. The mean of these two times should then be taken as the actual time over the fix.

(4) If a position is given with respect to distance and direction from a reporting point, the distance and direction should be computed as accurately as possible.

(5) Except for terminal area transition purposes, position reports or navigation with reference to aids not established for use in the structure in which flight is being conducted will not normally be required by ATC.

b. POSITION REPORTING POINTS

(1) FARs require pilots to maintain a listening watch on the appropriate frequency and, unless operating under the provisions of (c), to furnish position reports passing certain reporting points. Reporting points are indicated by symbols on en route charts. The designated compulsory reporting point symbol is a solid triangle and the "on request" reporting point symbol is the open triangle. Reports passing an "on request" reporting point are only necessary when requested by ATC.

c. POSITION REPORTING REQUIREMENTS

(1) **Flights along airways or routes —** A position report is required by all flights regardless of altitude, including those operating in accordance with an ATC clearance specifying "VFR ON TOP," over each designated compulsory reporting point along the route being flown.

(2) **Flight Along a Direct Route —** Regardless of the altitude or flight level being flown, including flights operating in accordance with an ATC clearance specifying "VFR ON TOP", pilots shall report over each reporting point used in the flight plan to define the route of flight.

(3) **Flights in a Radar Environment —** When informed by ATC that their aircraft are in "RADAR CONTACT," PILOTS SHOULD DISCONTINUE POSITION REPORTS OVER DESIGNATED REPORTING POINTS. They should resume normal position reporting when ATC advises "RADAR CONTACT LOST" or "RADAR SERVICE TERMINATED."

NOTE.— ATC will inform a pilot that he is in "RADAR CONTACT" (a) when his aircraft is initially identified in the ATC system; and (b) when radar identification is reestablished after radar service has been terminated or radar contact lost. Subsequent to being advised that the controller has established radar contact, this fact will not be repeated to the pilot when handed off to another controller. At times, the aircraft identity will be *confirmed* by the receiving controller; however, this should not be construed to mean that radar contact has been lost. The identity of transponder equipped aircraft will be confirmed by asking the pilot to "IDENT," "SQUAWK STANDBY," or to change codes. Aircraft without transponders will be advised of their position to confirm identity. In this case, *the pilot is expected to advise the controller if he disagrees with the position given.* If the pilot cannot confirm the accuracy of the position given because he is not tuned to the NAVAID referenced by the controller, the pilot should ask for another radar position relative to the NAVAID to which he is tuned.

d. POSITION REPORT ITEMS

(1) Position reports should include the following items:

(a) Identification.

(b) Position.

(c) Time.

(d) Altitude or flight level (include actual altitude or flight level when operating on a clearance specifying VFR ON TOP.)

(e) Type of flight plan (not required in IFR position reports made directly to ARTCCs or approach control),

(f) ETA and name of next reporting point.

(g) The name only of the next succeeding reporting point along the route of flight, and

(h) Pertinent remarks.

342. ADDITIONAL REPORTS

a. The following reports should be made to ATC or FSS facilities without a specific ATC request:

(1) *At all times:*

(a) When vacating any previously assigned altitude or flight level for a newly assigned altitude or flight level.

(b) When an altitude change will be made if operating on a clearance specifying VFR ON TOP.

(c) When *unable* to climb/descend at a rate of at least 500 feet per minute.

(d) When approach has been missed. (Request clearance for specific action; i.e., to alternative airport, another approach, etc.)

(e) Change in the average true airspeed (at cruising altitude) when it varies by 5 percent or 10 knots (whichever is greater) from that filed in the flight plan.

(f) The time and altitude or flight level upon reaching a holding fix or point to which cleared.

(g) When leaving any assigned holding fix or point

NOTE.— The reports in subparagraphs (f) and (g) may be omitted by pilots of aircraft involved in instrument training at military terminal area facilities when radar service is being provided.

(h) Any loss, in controlled airspace, of VOR, TACAN, ADF, low frequency navigation receiver capability, complete or partial loss of ILS receiver capability or impairment of air/ground communications capability.

(1) Any information relating to the safety of flight.

(2) *When not in radar contact:*

(a) When leaving final approach fix inbound on final approach (non precision approach) or when leaving the outer marker or fix used in lieu of the outer marker inbound on final approach (precision approach).

(b) A corrected estimate at anytime it becomes apparent that an estimate as previously submitted is in error in excess of 3 minutes.

b. Pilots encountering weather conditions which have not been forecast, or hazardous conditions which have been forecast, are expected to forward a report of such weather to ATC. (See PARA—520 - PILOT WEATHER REPORTS (PIREPs) and FAR—91.125(b) and (c).)

343. AIRWAYS AND ROUTE SYSTEMS

a. Three route systems have been established for air navigation purposes. They are the VOR and L/MF system, the jet route system, and the area navigation (RNAV) route system. To the extent possible, these route systems are aligned in an overlying manner to facilitate transition between each.

(1) The VOR and L/MF Airway System consists of airways designated from 1,200 feet above the surface (or in some instances higher) up to but not including 18,000 feet MSL. These airways are depicted on En Route Low Altitude Charts.

(a) THE VOR AIRWAYS are predicated solely on VOR or VORTAC navigation aids, except in Alaska, and are depicted in blue on aeronautical charts and are identified by a "V" (Victor) followed by the airway number (e.g., V12).

NOTE.— Segments of VOR airways in Alaska are based on L/MF navigation aids and charted in brown color instead of blue on en route charts.

1. A segment of an airway which is common to two or more routes carries the numbers of all the airways which coincide for that segment. When such is the case, a pilot filing a flight plan needs to indicate only that airway number of the route which he is using.

2. *Alternate Airways* are identified by their location with respect to the associated main airway. "Victor 9 West" indicates an alternate airway associated with, and lying to the west of Victor 9.

NOTE.— A pilot who intends to make an airway flight, using VOR facilities, will simply specify the appropriate "Victor" airways(s) in his flight plan. For example, if a flight is to be made from Chicago to New Orleans at 8,000 feet, using omniranges only, the route may be indicated as "Departing from Chicago-Midway, cruising 8,000 feet via Victor 9 to Moisant International." If flight is to be conducted in part by means of L/MF navigation aids and in part on omniranges, specifications of the appropriate airways in the flight plan will indicate which types of facilities will be used along the described routes, and, for IFR flight, permit ATC to issue a traffic clearance accordingly. A route may also be described by specifying the station over which the flight will pass, but in this case since many VOR's and L/MF aids have the same name, the pilot must be careful to indicate which aid will be used at a particular location. This will be indicated in the route of flight portion of the flight plan by specifying the type of facility to be used after the location name in the following manner: Newark L/MF, Allentown VOR.

3. With respect to position reporting, reporting points are designated for VOR Airway Systems. Flights using Victor Airways will report over these points unless advised otherwise by ATC.

(b) THE L/MF AIRWAYS (colored airways) are predicated solely on L/MF navigation aids and are depicted in brown on aeronautical charts and are identified by color name and number (e.g., Amber One). Green and Red airways are plotted east and west. Amber and Blue airways are plotted north and south.

NOTE.— The colored airway system exists only in the State of Alaska. All such airways formerly designated within the conterminous U.S. have been rescinded.

(2) THE JET ROUTE SYSTEM consists of jet routes established from 18,000 feet MSL to FL 450 inclusive.

(a) These routes are depicted on En Route High Altitude Charts. Jet routes are depicted in blue on aeronautical charts and are identified by a "J" (Jet) followed by the airway number (e.g., J 12). Jet routes, as VOR airways, are predicated solely on VOR or VORTAC navigation facilities (except in Alaska).

NOTE.— Segments of jet routes in Alaska are based on L/MF navigation aids and are charted in brown color instead of blue on en route charts.

(b) With respect to position reporting, reporting points are designated for Jet Route systems. Flights using Jet Routes will report over these points unless otherwise advised by ATC.

(3) AREA NAVIGATION (RNAV) ROUTE SYSTEM

(a) Area navigation systems permit aircraft operations on any desired course within the coverage of station-referenced navigation signals or within the limits of self-contained system capability. Typical of such systems are VOR/DME RNAV, INS, LORAN C, and OMEGA.

(b) Except for a few high altitude Alaskan routes, there is no longer a U.S. RNAV route system. Provisions are retained for designation of RNAV routes if they are required; however, these routes would be depicted on En Route High Altitude Charts. Special certification requirements for RNAV equipment apply to these routes.

(c) In the absence of established RNAV routes, random RNAV routes may be filed, but radar monitoring by ATC will be required.

b. OPERATION ABOVE FL 450 may be conducted on a point-to-point basis. Navigational guidance is provided on an area basis utilizing those facilities depicted on the En Route High Altitude Charts.

c. Radar Vectors. Controllers may vector aircraft within controlled airspace for separation purposes, noise abatement considerations, when an operational advantage will be realized by the pilot or the controller, or when requested by the pilot. Vectors outside of controlled airspace will be provided only on pilot request. Pilots will be advised as to what the vector is to achieve when the vector is controller initiated and will take the aircraft off a previously assigned nonradar route. To the extent possible, aircraft operating on RNAV routes will be allowed to remain on their own navigation.

d. Pilots are cautioned when flying in Canadian airspace, to review Canadian Air Regulations.

(1) Special attention should be given to the parts which differ from U.S. FARs.

(a) The Canadian Airways CLASS B airspace restriction is an example. CLASS B airspace is all controlled low level airspace above 12,500 feet MSL or the MEA, whichever is higher, within which only IFR and controlled VFR flights are permitted. (Low level airspace means an airspace designated and defined as such in the *Designated Airspace Handbook.)*

(b) Regardless of the weather conditions or the height of the terrain, no person shall operate an aircraft under VFR conditions within CLASS B airspace except in accordance with a clearance for VFR flight issued by ATC.

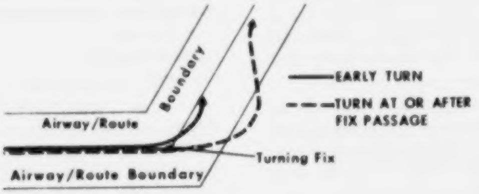
(c) Unless otherwise authorized by the Director General, Civil Aeronautics of the Department of Transportation, no person holding a commercial or private pilot license without an instrument rating shall operate an aircraft in VFR flight within CLASS B airspace unless successful completion of a written examination demonstrating knowledge of radio navigation and of ATC procedures applicable to IFR flight including clearances and position reports is accomplished. The pilot license must be endorsed to that effect.

(2) Segments of VOR airways and high level routes in Canada are based on L/MF navigation aids and are charted in brown color instead of blue on en route charts.

344. AIRWAY OR ROUTE COURSE CHANGES

a. Pilots of aircraft are required to adhere to airways or routes being flown. Special attention must be given to this requirement during course changes. Each course change consists of variables that make the technique applicable in each case a matter only the pilot can resolve. Some variables which must be considered are turn radius, wind effect, airspeed, degree of turn, and cockpit instrumentation. An early turn, as illustrated below, is one method of adhering to airways or routes. The use of any available cockpit instrumentation, such as distance measuring equipment, may be used by the pilot to lead his turn when making course changes. This *is consistent* with the intent of FAR–91.123, which requires pilots to operate along the centerline of an airway and along the direct course between navigational aids or fixes.

b. Turns which begin at or after fix passage may exceed airway or route boundaries. The following illustration contains an example flight track depicting this, together with an example of an early turn.



c. Without such actions as leading a turn, aircraft operating in excess of 290 knots TAS can exceed the normal airway or route boundaries depending on the amount of course change required, wind direction and velocity, the character of the turn fix (DME, overhead navigation aid, or intersection), and the pilot's technique in making a course change. For example, a flight operating at 17,000 feet MSL with a TAS of 400 knots, a 25 degree bank, and a course change of more than 40 degrees would exceed the width of the airway or route; i.e., 4 nautical miles each side of centerline. However, in the airspace below 18,000 feet MSL, operations in excess of 290 knots TAS are not prevalent and the provision of additional IFR separation in all course change situations for the occasional aircraft making a turn in excess of 290 knots TAS creates an unacceptable waste of airspace and imposes a penalty upon the preponderance of traffic which operate at low speeds. Consequently, the FAA expects pilots to lead turns and take other actions they consider necessary during course changes to adhere as closely as possible to the airways or route being flown.

d. Due to the high airspeeds used at 18,000 feet MSL and above, FAA provides additional IFR separation protection for course changes made at such altitude levels.

345. CHANGEOVER POINTS (COP)

a. COPs are prescribed for federal airways, jet routes area navigation routes, or other direct routes for which a MEA is designated under FAR—95. The COP is a poin along the route or airway segment between two adjacent navigation facilities or way points where changeover i navigation guidance should occur. At this point, the pil should change navigation receiver frequency from the sta- tion behind the aircraft to the station ahead.

b. The COP is located midway between the navigatio facilities for straight route segments, or at the intersectio of radials or courses forming a dogleg in the case of dogle route segments. When the COP is NOT located at th midway point, aeronautical charts will depict the COP lo cation and give the mileage to the radio aids.

c. COPs are established for the purpose of preventin loss of navigation guidance, to prevent frequency interfe ence from other facilities, and to prevent use of differen facilities by different aircraft in the same airspace. Pilo are urged to observe COPs to the fullest extent.

346. OPERATION IN RESTRICTED AIRSPACE

a. ATC facilities apply the following procedures when aircraft are operating on an IFR clearance (including those cleared by ATC to maintain VFR ON TOP) via a route which lies within joint-use restricted airspace.

(1) If the restricted area is not active and has been released to the controlling agency (FAA), the ATC facility will allow the aircraft to operate in the restricted airspace without issuing specific clearance for it to do so.

(2) If the restricted area is active and has not been released to the controlling agency (FAA), the ATC facility will issue a clearance which will ensure the aircraft avoids the restricted airspace unless it is on an approved altitude reservation mission or has obtained its own permission to operate in the airspace and so informs the controlling facility.

NOTE.— The above apply only to joint-use restricted airspace and not to prohibited and nonjoint-use airspace. For the latter categories, the ATC facility will issue a clearance so the aircraft will avoid the restricted airspace unless it is on an approved altitude reservation mission or has obtained its own permission to operate in the airspace and so informs the controlling facility.

b. Restricted airspace is depicted on the En Route Chart appropriate for use at the altitude or flight level being flown. For joint-use restricted areas, the name of the controlling agency is shown on these charts. For all prohibited areas and nonjoint-use restricted areas, unless otherwise requested by the using agency, the phrase "NO A/G" is shown.

347. HOLDING

a. Whenever an aircraft is cleared to a fix other than the destination airport and delay is expected, it is the responsibility of the ATC controller to issue complete holding instructions (unless the pattern is charted), * an EFC time and his best estimate of any additional en route/terminal delay.

b. If the holding pattern is charted and the controller doesn't issue complete holding instructions, the pilot is expected to hold as depicted on the appropriate chart. When the pattern is charted, the controller may omit all holding instructions except the charted holding direction and the statement *AS PUBLISHED* e.g., *HOLD EAST AS PUBLISHED.* Controllers shall always issue complete holding instructions when pilots request them.

NOTE.—* Only those holding patterns depicted on U.S. Government or commercially produced (meeting FAA requirements) *Low/High Altitude En route, and Area or STAR* charts should be used.

c. If no holding pattern is charted and holding instructions have not been issued, the pilot should ask ATC for holding instructions prior to reaching the fix. This procedure will eliminate the possibility of an aircraft entering a holding pattern other than that desired by ATC. If the pilot is unable to obtain holding instructions prior to reaching the fix (due to frequency congestion, stuck microphone, etc.), he should hold in a standard pattern on the course on which he approached the fix and request further clearance as soon as possible. In this event, the altitude/flight level of the aircraft at the clearance limit will be protected so that separation will be provided as required.

d. When an aircraft is 3 minutes or less from a clearance limit and a clearance beyond the fix has not been received, the pilot is expected to start a speed reduction so that he will cross the fix, initially, at or below the maximum holding airspeed.

e. When no delay is expected, the controller should issue a clearance beyond the fix as soon as possible and, whenever possible, at least 5 minutes before the aircraft reaches the clearance limit.

f. Pilots should report to ATC the time and altitude/flight level at which the aircraft reaches the clearance limit and report leaving the clearance limit.

NOTE.— In the event of two-way communications failure, pilots are required to comply with FAR 91.127.

g. When holding at a VOR station, pilots should begin the turn to the outbound leg at the time of the first complete reversal of the to/from indicator.

h. Patterns at the most generally used holding fixes are depicted (charted) on U.S. Government or commercially produced (meeting FAA requirements) Low or High Altitude En route, Area and STAR Charts. Pilots are expected to hold in the pattern depicted unless specifically advised otherwise by ATC.

i. An ATC clearance requiring an aircraft to hold at a fix where the pattern is not charted will include the following information:

(1) Direction of holding from the fix in terms of the eight cardinal compass points (i.e., N, NE, E, SE, etc.).

(2) Holding fix (the fix may be omitted if included at the beginning of the transmission as the clearance limit).

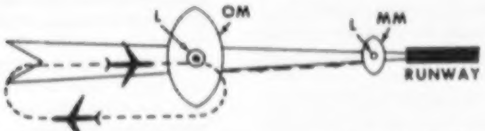
(3) Radial, course, bearing, airway or route on which the aircraft is to hold.

(4) Leg length in miles if DME or RNAV is to be used (leg length will be specified in minutes on pilot request or if the controller considers it necessary).

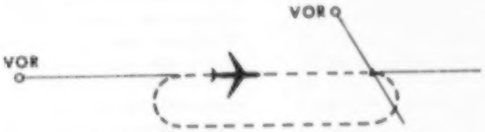
(5) Direction of turn if left turns are to be made, the pilot requests, or the controller considers it necessary.

(6) Time to expect further clearance and any pertinent additional delay information.

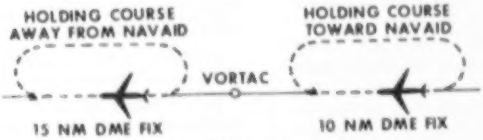
EXAMPLES OF HOLDING


L
OM
L
MM
RUNWAY

TYPICAL PROCEDURE ON AN ILS OUTER MARKER



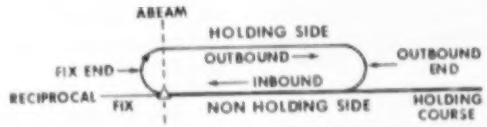
TYPICAL PROCEDURE AT INTERSECTION OF VOR RADIALS


HOLDING COURSE AWAY FROM NAVAID
HOLDING COURSE TOWARD NAVAID
VORTAC
15 NM DME FIX
10 NM DME FIX

TYPICAL PROCEDURE AT DME FIX

j. Holding pattern airspace protection is based on the following procedures. They are the only procedures for entry and holding recommended by FAA.

(1) **Descriptive Terms**


ABEAM
HOLDING SIDE
OUTBOUND
INBOUND
FIX END
OUTBOUND END
RECIPROCAL
FIX
NON HOLDING SIDE
HOLDING COURSE

(a) **Standard Pattern : Right turns (illustrated)**

(b) **Nonstandard Pattern : Left turns**

(2) **Airspeeds (maximum)**

(a) Propeller-driven

1. All (including turboprop) .... 175K IAS

(b) Civil turbojet

1. MHA through 6,000 feet .... 200K IAS
2. Above 6,000 feet through 14,000 feet .... 210K IAS
3. Above 14,000 feet .... 230K IAS

(c) Military turbojet

1. All-except aircraft listed below .... 230K IAS
2. F-84F, F-100, F-102, F-104, F-106, T-38, F-4, F-8, F-11, F-14, F-15, F-16, A-5, A-7 (USAF only), AV-8 .... 265K I
3. F-4 (USAF only) .... 280K I
4. F-100, F/RF-101, F-104, F-105, F-111, SR-71 .... 310K I
5. T-37 .... 175K I

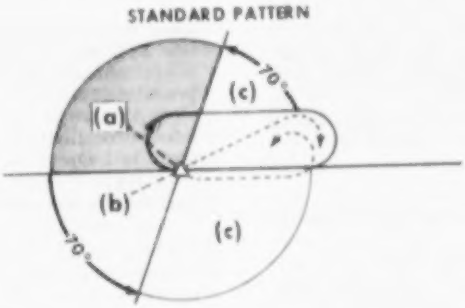
NOTE.— Holding speed depends upon weight and drag confi ration.

(3) **Entry**

(a) Parallel Procedure — Parallel holding course, turn left, and return to holding fix or intercept holding course.

(b) Teardrop Procedure — Proceed on outbound track of 30 degrees (or less) to holding course, turn right to intercept holding course.

(c) Direct Entry Procedure — Turn right and fly the pattern.



(4) Timing:

(a) Inbound Leg

1. At/below 14,000 Ft. MSL - 1 minute.
2. Above 14,000 Ft. MSL - 1 and 1/2 minute.

NOTE.— The *initial* outbound leg should be flown for 1 minute or 1 and 1/2 min. (appropriate to altitude). Timing for subsequent outbound legs should be adjusted as necessary to achieve proper inbound leg time. Pilots may use any navigational means available (i.e. DME, RNAV, etc.) to insure the appropriate inbound leg times.

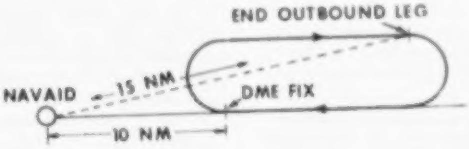
(b) Outbound leg timing begins *over / abeam* the fix, whichever occurs later. If the *abeam* position cannot be determined, start timing when turn to outbound is completed.

(5) Distance Measuring Equipment (DME)

(a) DME holding is subject to the same entry and holding procedures except that distances (nautical miles) are used in lieu of time values. The *outbound course* of a DME holding pattern is called the outbound leg of the pattern. The length of the outbound leg will be specified by the controller. The end of the outbound leg is determined by the odometer reading.

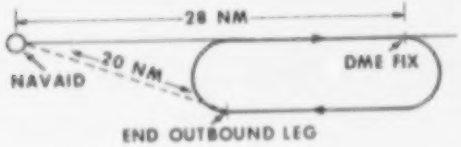
EXAMPLE:

When the inbound course is *toward* the NAVAID and the fix distance is 10 NM, and the leg length is 5NM, then the end of the outbound leg will be reached when the DME reads 15 NM.



EXAMPLE:

When the inbound course is *away* from the NAVAID and the fix distance is 28 NM and the leg length is 8 NM, then the end of the outbound leg will be reached when the DME reads 20 NM.



(6) Pilot Action

(a) Start speed reduction when 3 minutes or less from the holding fix. Cross the holding fix, initially, at or below the maximum holding airspeed.

(b) Make all turns during entry and while holding at:

1. 3 degrees per second, or

2. 30 degree bank angle, or

3. 25 degree bank provided a flight director system is used.

NOTE.— Use whichever requires the least bank angle.

(c) Compensate for wind effect primarily by drift correction on the inbound and outbound legs. When outbound, double the (inbound) drift correction to avoid major turning adjustments; e.g., if correcting left by 8 degrees when inbound, correct right by 16 degrees when outbound.

(d) Determine entry turn from aircraft heading upon arrival at the holding fix. Plus/minus 5 degrees in heading is considered to be within allowable good operating limits for determining entry.

(e) Advise ATC immediately if any increased airspeed is necessary due to turbulence, icing, etc., or if unable to accomplish any part of the holding procedures. When such higher speeds become no longer necessary, operate according to the appropriate published holding speed and notify ATC.

NOTE.— Airspace protection for turbulent air holding is based on a maximum of 280K IAS/Mach 0.8, whichever is lower. Considerable impact on traffic flow will result when turbulent air holding patterns are used; thus, pilot discretion will ensure their use is limited to bona fide conditions or requirements.

(7) Nonstandard Holding Pattern — Fix end and outbound end turns are made to the left. Entry procedures to a nonstandard pattern are oriented in relation to the 70 degree line on the holding side just as in the standard pattern.

k. When holding at a fix and instructions are received specifying the time of departure from the fix, the pilot should adjust his flight path within the limits of the established holding pattern in order to leave the fix at the exact time specified. After departing the holding fix, normal speed is to be resumed with respect to other governing speed requirements such as terminal area speed limits, specific ATC requests, etc. Where the fix is associated with an instrument approach, and timed approaches are in effect, a procedure turn shall not be executed unless the pilot advises ATC, since aircraft holding are expected to proceed inbound on final approach directly from the holding pattern when approach clearance is received.

l. RADAR SURVEILLANCE OF OUTER FIX HOLDING PATTERN AIRSPACE AREAS.

(1) Whenever aircraft are holding at an outer fix ATC will usually provide radar surveillance of the outer fix holding pattern airspace area, or any portion of it, if it is shown on the controller's radar scope.

(2) The controller will attempt to detect any holding aircraft that stray outside the holding pattern airspace area and will assist any detected aircraft to return to the assigned airspace area.

NOTE.— Many factors could prevent ATC from providing the additional service, such as workload, number of targets, precipitation, ground clutter, and radar system capability. These circumstances may make it unfeasible to maintain radar identification of aircraft to detect aircraft straying from the holding pattern. The provision of this service depends entirely upon whether the controller believes he is in a position to provide it and does not relieve a pilot of his responsibility to adhere to an accepted ATC clearance.

(3) If an aircraft is established in a published holding pattern at an assigned altitude above the published minimum holding altitude and subsequently cleared for the approach, the pilot may descend to the published minimum holding altitude. The holding pattern would only be a segment of the IAP *if* it is published on the instrument procedure chart and is used in lieu of a procedure turn.

m. For those holding patterns where there are no published minimum holding altitudes, the pilot, upon receiving an approach clearance, must maintain his last assigned altitude until leaving the holding pattern and established on the inbound course. Thereafter, the published minimum altitude of the route segment being flown will apply. It is expected that the pilot will be assigned a holding altitude that will permit a normal descent on the inbound course

348—359. RESERVED

Section 8. ARRIVAL PROCEDURES

360. STANDARD TERMINAL ARRIVAL (STAR)

a. A STAR is an ATC coded IFR arrival route established for application to arriving IFR aircraft destined for certain airports. Its purpose is to simplify clearance delivery procedures.

b. Pilots of IFR civil aircraft destined to locations for which STARs have been published may be issued a clearance containing a STAR whenever ATC deems it appropriate. Until military STAR publications and distribution is accomplished, STARs will be issued to military pilots only when requested in the flight plan or verbally by the pilot.

c. Use of STARs requires pilot possession of at least the approved textual description. As with any ATC clearance or portion thereof, it is the responsibility of each pilot to accept or refuse an issued STAR. A pilot should notify ATC if he does not wish to use a STAR by placing "NO STAR" in the remarks section of the flight plan or by the less desirable method of verbally stating the same to ATC.

d. A bound booklet containing all STAR charts is available on subscription from the National Ocean Service.

361. LOCAL FLOW TRAFFIC MANAGEMENT PROGRAM

a. This program is a continuing effort by the FAA to enhance safety, minimize the impact of aircraft noise and conserve aviation fuel. The enhancement of safety and reduction of noise is achieved in this program by minimizing low altitude maneuvering of arriving turbojet and turboprop aircraft weighing more than 12,500 pounds and, by permitting departure aircraft to climb to higher altitudes sooner, as arrivals are operating at higher altitudes at the points where their flight paths cross. The application of these procedures also reduces exposure time between controlled aircraft and uncontrolled aircraft at the lower altitudes in and around the terminal environment. Fuel conservation is accomplished by absorbing any necessary arrival delays for aircraft included in this program operating at the higher and more fuel efficient altitudes.

b. A fuel efficient descent is basically an uninterrupted descent (except where level flight is required for speed adjustment) from cruising altitude to the point when level flight is necessary for the pilot to stabilize his final approach. The procedure for a fuel efficient descent is based on an altitude loss which is most efficient for the majority of aircraft being served. This will generally result in a descent gradient window of 250-350 feet per nautical mile.

c. When crossing altitudes and speed restrictions are issued verbally or are depicted on a chart, ATC will expect the pilot to descend first to the crossing altitude and then *reduce speed. Verbal clearances for descent* will normally permit an uninterrupted descent in accordance with the procedure as described in paragraph b. above. Acceptance of a charted fuel efficient descent (Runway Profile Descent) clearance requires the pilot to adhere to the altitudes, speeds, and headings depicted on the charts unless otherwise instructed by ATC. PILOTS RECEIVING A CLEARANCE FOR A FUEL EFFICIENT DESCENT ARE EXPECTED TO ADVISE ATC IF THEY DO NOT HAVE RUNWAY PROFILE DESCENT CHARTS PUBLISHED FOR THAT AIRPORT OR ARE UNABLE TO COMPLY WITH THE CLEARANCE.

362. APPROACH CONTROL

a. Approach control is responsible for controlling all instrument flight operating within its area of responsibility. Approach control may serve one or more airfields, and control is exercised primarily by direct pilot and controller communications. Prior to arriving at the destination radio facility, instructions will be received from ARTCC to contact approach control on a specified frequency.

b. Radar Approach Control

(1) Where radar is approved for approach control service, it is used not only for radar approaches (ASR and PAR) but is also used to provide vectors in conjunction with published nonradar approaches based on radio NAVAIDs (ILS, MLS, VOR, NDB, TACAN). Radar vectors can provide course guidance and expedite traffic to the final approach course of any established IAP or to the traffic pattern for a visual approach. Approach control facilities that provide this radar service will operate in the following manner:

(a) Arriving aircraft are either cleared to an outer fix most appropriate to the route being flown with vertical separation and, if required, given holding information or, when radar handoffs are effected between the ARTCC and approach control, or between two approach control facilities, aircraft are cleared to the airport or to a fix so located that the handoff will be completed prior to the time the aircraft reaches the fix. When radar handoffs are utilized, successive arriving flights may be handed off to approach control with radar separation in lieu of vertical separation.

(b) After release to approach control, aircraft are vectored to the final approach course (ILS, MLS, VOR, ADF, etc.). Radar vectors and altitude or flight levels will be issued as required for spacing and separating aircraft. *Therefore, pilots must not deviate from the headings issued by approach control.* Aircraft will normally be informed when it is necessary to vector across the final approach course for spacing or other reasons. If approach course crossing is imminent and the pilot has not been informed that he will be vectored across the final approach course, he should query the controller.

(c) The pilot is not expected to turn inbound on the final approach course unless an approach clearance has been issued. This clearance will normally be issued with the final vector for interception of the final approach course, and the vector will be such as to enable the pilot to establish his aircraft on the final approach course prior to reaching the final approach fix.

(d) In the case of aircraft already inbound on the final approach course, approach clearance will be issued

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**Federal Aviation
Administration**

Airman's Information Manual

Official Guide to Basic Flight Information and ATC Procedures

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AIRMAN'S INFORMATION MANUAL (AIM)

BASIC FLIGHT INFORMATION AND ATC PROCEDURES

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The Federal Aviation Administration is responsible for insuring the safe and efficient use of the Nation's airspace, by military as well as civil aviation, for fostering civil aeronautics and air commerce in the United States and abroad, and for supporting the requirements of national defense.

The activities required to carry out these responsibilities include: safety regulation; airspace management and the establishment, operation, and maintenance of a civil-military common system of air traffic control and navigation facilities; research and development in support of the fostering of a national system of airports, promulgation of standards and specifications for civil airports, and administration of Federal grants-in-aid for developing public airports; various joint and cooperative activities with the Department of Defense; and technical assistance (under State Department auspices) to other countries.

FLIGHT INFORMATION PUBLICATION POLICY

The following is, in essence, the statement issued by the FAA Administrator and published in the December 10, 1964, issue of the Federal Register, concerning the FAA policy as pertaining to the type of information that will be published as NOTAMs and in the Airman's Information Manual.

It is a pilot's inherent responsibility that he be alert at all times for and in anticipation of all circumstances, situations and conditions which affect the safe operation of his aircraft. For example, a pilot should expect to find air traffic at any time or place. At or near both civil and military airports and in the vicinity of known training areas, a pilot should expect concentrated air traffic although he should realize concentrations of air traffic are not limited to these places.

It is the general practice of the agency to advertise by NOTAM or other flight information publications such information it may deem appropriate; information which the agency may from time to time make available to pilots is solely for the purpose of assisting them in executing their regulatory responsibilities. Such information serves the aviation community as a whole and not pilots individually.

The fact that the agency under one particular situation or another may or may not furnish information does not serve as a precedent of the agency's responsibility to the aviation community; neither does it give assurance that other information of the same or similar nature will be advertised nor does it guarantee that any and all information known to the agency will be advertised.

Consistent with the foregoing, it shall be the policy of the Federal Aviation Administration to furnish information only when, in the opinion of the agency, a unique situation should be advertised and not to furnish routine information such as concentrations of air traffic, either civil or military. The Airman's Information Manual will not contain informative items concerning everyday circumstances that pilots should, either by good practice or regulation, expect to encounter or avoid.

AIRMAN'S INFORMATION MANUAL (AIM)

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AIRMAN'S INFORMATION MANUAL (AIM)

FOREWORD

This manual is designed to provide airmen with basic flight information and ATC procedures for use in the National Airspace System (NAS) of the United States. The information contained parallels the U.S. Aeronautical Information Publication (AIP) distributed internationally.

This manual contains the fundamentals required in order to fly in the U.S. NAS. It also contains items of interest to pilots concerning health and medical facts, factors affecting flight safety, a pilot/controller glossary of terms used in the Air Traffic Control System, and information on safety, accident and hazard reporting.

This manual is complemented by other operational publications which are available upon separate subscription. These publications are:

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NOTE— The above information relating to FARs and ACs is extracted from AC 00-2, *Advisory Circulars and Status of Federal Regulations.* Many of the FARs and ACs listed in AC 00-2 are cross-referenced in the AIM. These regulatory and nonregulatory references cover a wide range of subjects and are a source of detailed information of value to airmen. AC 00-2 is issued every four months and can be obtained free-of-charge from:

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AUGUST 28, 1986

AIRMAN'S INFORMATION MANUAL

EXPLANATION OF MAJOR CHANGES

Para 20. LORAN— Paragraph revised and updated.

Para 22. b c VHF DIRECTION FINDER— Paragraph revised to show ASR-3 radarscopes are no longer in operation and DF indicators are now installed in FSS's which are not radar equipped.

Para 42. b c OTHER VISUAL APPROACH SLOPE SYSTEMS— Paragraph caution notes expanded.

Para 90. GENERAL— This change adds Airport Radar Service Areas to controlled airspace.

Para 112. b c RESTRICTED AREA— Paragraph 346 concerns ATC procedures used when clearing aircraft on routes which will penetrate joint use restricted areas, while paragraph 112 deals specifically with the definition of and the limitations imposed by restricted areas. The two paragraphs have been consolidated to make it easier to locate the information pertaining to restricted areas.

Para 161. b EXAMPLE. AUTOMATIC TERMINAL INFORMATION SERVICE (ATIS)— Paragraph revised to indicate the term "ZULU" is used when ATC procedures require a reference to UTC.

Para 170. e (2) TRANSPONDER OPERATION— Paragraph revised to indicate the military interceptor code has been changed from 0001 to 7777.

Para 190. GENERAL— Paragraph modified by deleting repetitive information.

Para 204. a TIME— Paragraph revised to indicate the term "ZULU" is used when ATC procedures require a reference to UTC.

Para 240. FUEL ADVISORY DEPARTURE (FAD) PROCEDURES— Paragraph deleted. FAD procedures have [illegible] abolished and have been replaced by [illegible]und delay programs.

Para 244. e PRACTICE INSTRUMENT APPROACHES— Paragraph revised to reflect handbook changes.

Para 246. e USE OF AIRCRAFT LIGHTS— Paragraph was expanded to encourage pilots to turn on their aircraft landing lights during operations below 10,000 feet.

Para 290. PREFLIGHT PREPARATION— Paragraph modified by deleting repetitive information.

Para 298. d FLIGHT PLAN — IFR FLIGHTS— Paragraph revised to include additional information on area navigation, to correct outdated information, and make minor editorial changes.

Para 343. a (3) (a) (b) (c) AIRWAYS AND ROUTE SYSTEMS— Paragraph revised to include additional information on area navigation, to correct outdated information, and make minor editorial changes.

Para 346. OPERATION IN RESTRICTED AIRSPACE— Paragraph in its entirety was moved to paragraph 112. b and c.

Para 371. PROCEDURE TURN— Paragraph was amended to incorporate appropriate portions of AC 90-1.

Para 406. a (3) SAFETY ALERT— This subparagraph has been deleted because it is not a statement of a specific pilot responsibility and it is gratuitous in the sense that no service is a substitute for pilot adherence to safe operating practices.

Para 456. d SEARCH AND RESCUE— Telephone numbers have been changed at the Rescue Coordination Center, Elmendorf AFB, Alaska.

Para 501. c (3) FAA WEATHER SERVICE— Paragraph revised to alert pilots of the need to supplement the weather information from the IVRS with additional hazardous weather issuances from other sources.

Para 503. EN ROUTE FLIGHT ADVISORY SERVICE (EFAS)— Paragraph revised to change the recommended procedure for pilots to contact flight watch facilities, and provide a revised initial call-up procedure to be used when the pilot does not know in which flight watch area the aircraft is flying.

Para 508. b EXAMPLE. IN-FLIGHT WEATHER BROADCASTS— Paragraph revised to indicate the term "ZULU" is used when ATC procedures require a reference to UTC.

Para 540. b c GENERAL— Paragraph revised for clarity.

EXTERNAL REFERENCES

All reference to Advisory Circulars and other FAA publications in the Airman's Information Manual include the FAA Advisory Circular or Manual identification numbers (when available); however, due to varied publication dates, the basic publication letter is not included (Example: The Controller's Handbook 7110.65D is referenced as 7110.65.) To insure that you are consulting the latest information when referencing one of these other documents, use the FAA Advisory Circular AC: 00–2XX, Advisory Circular Checklist (and Status of Other FAA Publications).

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SUPPLEMENT

PILOT CONTROLLER GLOSSARY .... S—1

Chapter 1. NAVIGATION AIDS

Section 1. AIR NAVIGATION RADIO AIDS

1. GENERAL

Various types of air navigation aids are in use today, each serving a special purpose. These aids have varied owners and operators namely: the Federal Aviation Administration (FAA), the military services, private organizations, individual states and foreign governments. The FAA has the statutory authority to establish, operate, maintain air navigation facilities and to prescribe standards for the operation of any of these aids which are used for instrument flight in federally controlled airspace. These aids are tabulated in the Airport/Facility Directory.

2. NONDIRECTIONAL RADIO BEACON (NDB)

a. A low or medium frequency radio beacon transmits nondirectional signals whereby the pilot of an aircraft properly equipped can determine his bearing and "home" on the station. These facilities normally operate in the frequency band of 190 to 535 kHz and transmit a continuous carrier with either 400 or 1020 Hz modulation. All radio beacons except the compass locators transmit a continuous three-letter identification in code except during voice transmissions.

b. When a radio beacon is used in conjunction with the Instrument Landing System markers, it is called a Compass Locator.

c. Voice transmissions are made on radio beacons unless the letter "W" (without voice) is included in the class designator (HW).

d. Radio beacons are subject to disturbances that may result in erroneous bearing information. Such disturbances result from such factors as lightning, precipitation static, etc. At night radio beacons are vulnerable to interference from distant stations. Nearly all disturbances which affect the ADF bearing also affect the facility's identification. Noisy identification usually occurs when the ADF needle is erratic. Voice, music or erroneous identification may be heard when a steady false bearing is being displayed. Since ADF receivers do not have a "FLAG" to warn the pilot when erroneous bearing information is being displayed, the pilot should continuously monitor the NDB's identification.

3. VHF OMNI-DIRECTIONAL RANGE (VOR)

a. VORs operate within the 108.0 to 117.95 MHz frequency band and have a power output necessary to provide coverage within their assigned operational service volume. It is subject to line-of-sight restriction, and the range varies proportionally to the altitude of the receiving equipment. The normal service ranges for the various classes of VORs are given in PARA. 10.d.

b. Most VORs are equipped for voice transmission on the VOR frequency. VORs without voice capability are indicated by the letter "W" (without voice) included in the class designator (VORW).

c. The only positive method of identifying a VOR is by its Morse Code identification or by the recorded automatic voice identification which is always indicated by use of the word "VOR" following the range's name. Reliance on determining the identification of an omnirange should never be placed on listening to voice transmissions by the Flight Service Station (FSS) (or approach control facility) involved. Many FSSs remotely operate several omniranges with different names. In some cases, none of the VORs have the name of the "parent" FSS. During periods of maintenance, the facility may radiate a T-E-S-T code (— ● ●●● —) or the code may be removed.

d. Voice identification has been added to numerous VORs. The transmission consists of a voice announcement, "AIRVILLE VOR" alternating with the usual Morse Code identification.

e. The effectiveness of the VOR depends upon proper use and adjustment of both ground and airborne equipment.

(1) Accuracy: The accuracy of course alignment of the VOR is excellent, being generally plus or minus 1 degree.

(2) Roughness: On some VORs, minor course roughness may be observed, evidenced by course needle or brief flag alarm activity (some receivers are more susceptible to these irregularities than others). At a few stations, usually in mountainous terrain, the pilot may occasionally observe a brief course needle oscillation, similar to the indication of "approaching station." Pilots flying over unfamiliar routes are cautioned to be on the alert for these vagaries, and in particular, to use the "to/from" indicator to determine positive station passage.

(a) Certain propeller RPM settings or helicopter rotor speeds can cause the VOR Course Deviation Indicator to fluctuate as much as plus or minus six degrees. Slight changes to the RPM setting will normally smooth out this roughness. Pilots are urged to check for this modulation phenomenon prior to reporting a VOR station or aircraft equipment for unsatisfactory operation.

4. VOR RECEIVER CHECK

a. The FAA VOR test facility (VOT) transmits a test signal which provides users a convenient means to determine the operational status and accuracy of a VOR receiver while on the ground where a VOT is located. The airborne use of VOT is permitted; however, its use is strictly limited to those areas/altitudes specifically authorized in the Airport/Facility Directory or appropriate supplement.

b. To use the VOT service,tune in the VOT frequency on your VOR receiver. With the Course Deviation Indicator (CDI) centered, the omni-bearing selector should read 0 de-

grees with the to/from indication showing "from" or the omni-bearing selector should read 180 degrees with the to/from indication showing "to". Should the VOR receiver operate an RMI (Radio Magnetic Indicator), it will indicate 180 degrees on any OBS setting. Two means of identification are used. One is a series of dots and the other is a continuous tone. Information concerning an individual test signal can be obtained from the local FSS.

c. Periodic VOR receiver calibration is most important. If a receiver's Automatic Gain Control or modulation circuit deteriorates, it is possible for it to display acceptable accuracy and sensitivity close into the VOR or VOT and display out-of-tolerance readings when located at greater distances where weaker signal areas exist. The likelihood of this deterioration varies between receivers, and is generally considered a function of time. The best assurance of having an accurate receiver is periodic calibration. Yearly intervals are recommended at which time an authorized repair facility should recalibrate the receiver to the manufacturer's specifications.

d. Federal Aviation Regulations (FAR 91.25) provides for certain VOR equipment accuracy checks prior to flight under instrument flight rules. To comply with this requirement and to ensure satisfactory operation of the airborne system, the FAA has provided pilots with the following means of checking VOR receiver accuracy:

(1) VOT or a radiated test signal from an appropriately rated radio repair station.

(2) Certified airborne check points.

(3) Certified check points on the airport surface.

e. A radiated VOR test signal from an appropriately rated radio repair station serves the same purpose as an FAA VOR signal and the check is made in much the same manner as a VOT with the following differences:

(1) The frequency normally approved by the FCC is 108.0 MHz.

(2) Repair stations are not permitted to radiate the VOR test signal continuously; consequently, the owner or operator must make arrangements with the repair station to have the test signal transmitted. This service is not provided by all radio repair stations. The aircraft owner or operator must determine which repair station in his local area provides this service. A representative of the repair station must make an entry into the aircraft logbook or other permanent record certifying to the radial accuracy and the date of transmission. The owner, operator or representative of the repair station may accomplish the necessary checks in the aircraft and make a logbook entry stating the results. It is necessary to verify which test radial is being transmitted and whether you should get a "to" or "from" indication.

f. Airborne and ground check points consist of certified radials that should be received at specific points on the airport surface or over specific landmarks while airborne in the immediate vicinity of the airport.

(1) Should an error in excess of plus or minus 4 degrees be indicated through use of a ground check, or plus or minus 6 degrees using the airborne check, IFR flight shall not be attempted without first correcting the source of the error.

CAUTION: No correction other than the correction card figures supplied by the manufacturer should be applied in making these VOR receiver checks.

(2) Locations of airborne check points, ground check points and VOTs are published in the Airport/Facility Directory.

(3) If a dual system VOR (units independent of each other except for the antenna) is installed in the aircraft one system may be checked against the other. Turn both systems to the same VOR ground facility and note the indicated bearing to that station. The maximum permissible variations between the two indicated bearings is 4 degrees.

5. TACTICAL AIR NAVIGATION (TACAN)

a. For reasons peculiar to military or naval operations (unusual siting conditions, the pitching and rolling of a naval vessel, etc.) the civil VOR/DME system of air navigation was considered unsuitable for military or naval use. A new navigational system, TACAN, was therefore developed by the military and naval forces to more readily lend itself to military and naval requirements. As a result, the FAA has been in the process of integrating TACAN facilities with the civil VOR/DME program. Although the theoretical, or technical principles of operation of TACAN equipment are quite different from those of VOR/DME facilities, the end result, as far as the navigating pilot is concerned, is the same. These integrated facilities are called VORTAC's.

b. TACAN ground equipment consists of either a fixed or mobile transmitting unit. The airborne unit in conjunction with the ground unit reduces the transmitted signal to a visual presentation of both azimuth and distance information. TACAN is a pulse system and operates in the UHF band of frequencies. Its use requires TACAN airborne equipment and does not operate through conventional VOR equipment.

6. VHF OMNI-DIRECTIONAL RANGE/TACTICAL AIR NAVIGATION (VORTAC)

a. A VORTAC is a facility consisting of two components, VOR and TACAN, which provides three individual services: VOR azimuth, TACAN azimuth and TACAN distance (DME) at one site. Although consisting of more than one component, incorporating more than one operating frequency, and using more than one antenna system, a VORTAC is considered to be a unified navigational aid. Both components of a VORTAC are envisioned as operating simultaneously and providing the three services at all times.

b. Transmitted signals of VOR and TACAN are each identified by three-letter code transmission and are interlocked so that pilots using VOR azimuth with TACAN distance can be assured that both signals being received are definitely from the same ground station. The frequency channels of the VOR and the TACAN at each VORTAC facility are "paired" in accordance with a national plan to simplify airborne operation.

7. DISTANCE MEASURING EQUIPMENT (DME)

a. In the operation of DME, paired pulses at a specific spacing are sent out from the aircraft (this is the interrogation) and are received at the ground station. The ground

station (transponder) then transmits paired pulses back to the aircraft at the same pulse spacing but on a different frequency. The time required for the round trip of this signal exchange is measured in the airborne DME unit and is translated into distance (Nautical Miles) from the aircraft to the ground station.

b. Operating on the line-of-sight principle, DME furnishes distance information with a very high degree of accuracy. Reliable signals may be received at distances up to 199 NM at line-of-sight altitude with an accuracy of better than 1/2 mile or 3 percent of the distance, whichever is greater. Distance information received from DME equipment is SLANT RANGE distance and not actual horizontal distance.

c. DME operates on frequencies in the UHF spectrum between 962 MHz and 1213 MHz. Aircraft equipped with TACAN equipment will receive distance information from a VORTAC automatically, while aircraft equipped with VOR must have a separate DME airborne unit.

d. VOR/DME, VORTAC, ILS/DME, and LOC/DME navigation facilities established by the FAA provide course and distance information from collocated components under a frequency pairing plan. Aircraft receiving equipment which provides for automatic DME selection assures reception of azimuth and distance information from a common source when designated VOR/DME, VORTAC, ILS/DME, and LOC/DME are selected.

e. Due to the limited number of available frequencies, assignment of paired frequencies is required for certain military noncollocated VOR and TACAN facilities which serve the same area but which may be separated by distances up to a few miles. The military is presently undergoing a program to collocate VOR and TACAN facilities or to assign nonpaired frequencies to those that cannot be collocated.

f. VOR/DME, VORTAC, ILS/DME, and LOC/DME facilities are identified by synchronized identifications which are transmitted on a time share basis. The VOR or localizer portion of the facility is identified by a coded tone modulated at 1020 Hz or a combination of code and voice. The TACAN or DME is identified by a coded tone modulated at 1350 Hz. The DME or TACAN coded identification is transmitted one time for each three or four times that the VOR or localizer coded identification is transmitted. When either the VOR or the DME is inoperative, it is important to recognize which identifier is retained for the operative facility. A single coded identification with a repetition interval of approximately 30 seconds indicates that the DME is operative.

g. Aircraft equipment which provides for automatic DME selection assures reception of azimuth and distance information from a common source when designated VOR/DME, VORTAC and ILS/DME navigation facilities are selected. Pilots are cautioned to disregard any distance displays from automatically selected DME equipment when VOR or ILS facilities, which do not have the DME feature installed, are being used for position determination.

8—9. RESERVED

10. NAVAID SERVICE VOLUMES

a. Most air navigation radio aids which provide positive course guidance have a designated standard service volume (SSV). The SSV defines the reception limits of unrestricted NAVAIDS which are usable for random/unpublished route navigation.

b. A NAVAID will be classified as restricted if it does not conform to flight inspection signal strength and course quality standards throughout the published SSV. However, the NAVAID should not be considered usable at altitudes below that which could be flown while operating under random route IFR conditions (FAR 91.119), even though these altitudes may lie within the designated SSV. Service volume restrictions are first published in the Notices to Airman (NOTAM) and then with the alphabetical listing of the NAVAID's in the Airport/Facility Directory.

c. Standard Service Volume limitations do not apply to published IFR routes or procedures.

d. VOR/DME/TACAN STANDARD SERVICE VOLUMES (SSV)

Standard service volumes (SSVs) are graphically shown in Figures 10-1 through 10-5. The SSV of a station is indicated by using the class designator as a prefix to the station type designation.

EXAMPLE:

TVOR, LDME, and HVORTAC.

Within 25 NM, the bottom of the T service volume is defined by the curve in Figure 10-4. Within 40 NM, the bottoms of the L and H service volumes are defined by the curve in Figure 10-5.

SSV CLASS DESIGNATOR	ALTITUDE AND RANGE BOUNDARIES
T (Terminal)	From 1000 feet above ground level (AGL) up to and including 12,000 feet AGL at radial distances out to 25 NM. See Figures 10-3 and 10-4.
L (Low Altitude)	From 1000 feet AGL up to and including 18,000 feet AGL at radial distances out to 40 NM. See Figures 10-2 and 10-5.
H (High Altitude)	From 1000 feet AGL up to and including 14,500 feet AGL at radial distances out to 40 NM. From 14,500 feet AGL up to and including 60,000 feet at radial distances out to 100 NM. From 18,000 feet AGL up to and including 45,000 feet AGL at radial distances out to 130 NM. See Figures 10-1 and 10-5.

FIGURE 10-1. STANDARD HIGH ALTITUDE SERVICE VOLUME

(refer to FIGURE 5 for altitudes below 1000 feet)

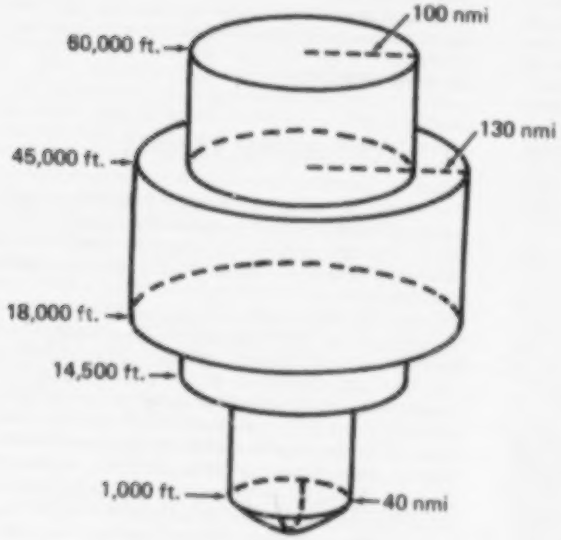
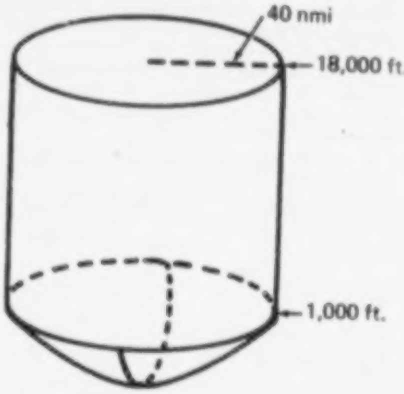

100 nmi
60,000 ft.
130 nmi
45,000 ft.
18,000 ft.
14,500 ft.
1,000 ft.
40 nmi

FIGURE 10-2. STANDARD LOW ALTITUDE SERVICE VOLUME

(refer to FIGURE 5 for altitudes below 1000 feet)


40 nmi
18,000 ft.
1,000 ft.

NOTE: All elevations shown are with respect to the station's site elevation (AGL). Coverage is not available in a cone of airspace directly above the facility.

FIGURE 10-3. STANDARD TERMINAL SERVICE VOLUME

(refer to FIGURE 4 for altitudes below 1000 feet)

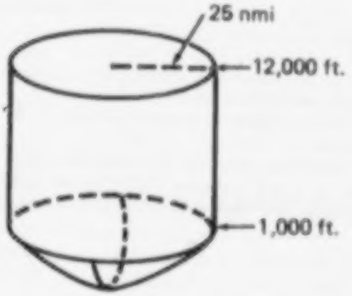

25 nmi
12,000 ft.
1,000 ft.

FIGURE 10-4. DEFINITION OF THE LOWER EDGE OF THE STANDARD T (TERMINAL) SERVICE VOLUME

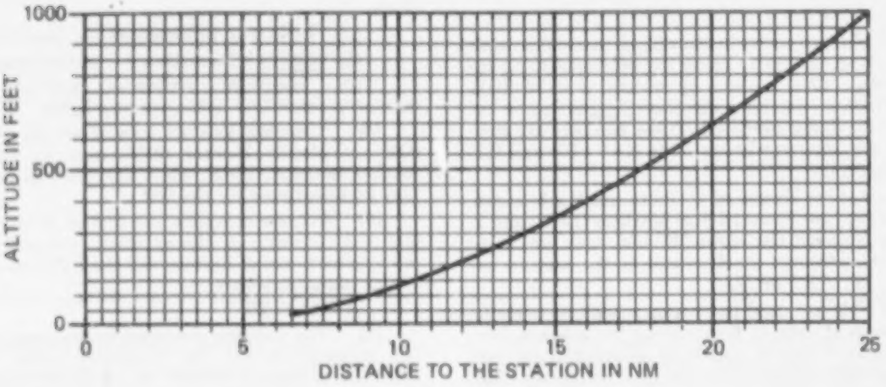
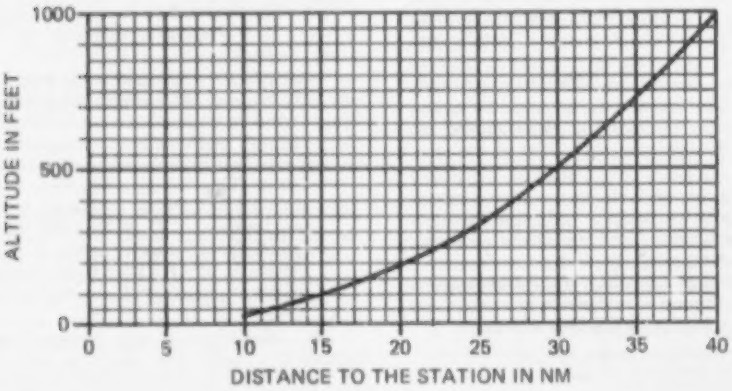


FIGURE 10-5. DEFINITION OF THE LOWER EDGE OF THE STANDARD H (HIGH) AND L (LOW) SERVICE VOLUMES



e. NONDIRECTIONAL RADIO BEACON (NDB)

NDBs are classified according to their intended use. The ranges of NDB service volumes are shown below. The distances (radius) are the same at all altitudes.

CLASS	DISTANCE (RADIUS)
Compass Locator	15 NM
MH	25 NM
H	50 NM*
HH	75 NM

* Service ranges of individual facilities may be less than 50 nautical miles (NM). Restrictions to service volumes are first published in the Notice to Airmen and then with the alphabetical listing of the NAVAID in the Airport/Facility Directory.

11. MARKER BEACON

a. Marker beacons serve to identify a particular location in space along an airway or on the approach to an instrument runway. This is done by means of a 75 MHz transmitter which transmits a directional signal to be received by aircraft flying overhead. These markers are generally used in conjunction with en route NAVAIDs and ILS as point designators.

b. There are three classes of en route marker beacons: Fan Marker (FM), Low Powered Fan Markers (LFM) and Z Markers. They transmit the letter "R" (dot dash dot) identification, or (if additional markers are in the same area) the letter "K," "P," "X," or "Z."

(1) Class FMs are used to provide a positive identification of positions at definite points along the airways. The transmitters have a power output of approximately 100 watts. Two types of antenna array are used with class FMs.

(a) The first type used, and generally referred to as the standard type, produces an elliptical shaped pattern, which, at an elevation of 1,000 feet above the station, is about 4 NM wide and 12 NM long. At 10,000 feet the pattern widens to about 12 NM wide and 35 NM long.

(b) The second array produces a dumbbell or boneshaped pattern, which, at the "handle", is about three miles wide at 1,000 feet. The boneshaped marker is preferred at approach control locations where "timed" approaches are used.

(2) The class LFM or low powered FMs have a rated power output of 5 watts. The antenna array produces a circular pattern which appears elongated at right angles to the airway due to the directional characteristics of the aircraft receiving antenna.

(3) The Station Location, or Z-Marker, was developed to meet the need for a positive position indicator for aircraft operating under instrument flight conditions to show the pilot when he was passing directly over a low frequency navigational aid. The marker consists of a 5 watt transmitter and a directional antenna array which is located on the range plot between the towers or the loop antennas.

NOTE— Information concerning marker beacons which are used in conjunction with ILS systems is included in PARA. 12 - INSTRUMENT LANDING SYSTEMS (ILS).

12. INSTRUMENT LANDING SYSTEM (ILS)

a. GENERAL

(1) The ILS is designed to provide an approach path for exact alignment and descent of an aircraft on final approach to a runway.

(2) The ground equipment consists of two highly directional transmitting systems and, along the approach, three (or fewer) marker beacons. The directional transmitters are known as the localizer and glide slope transmitters.

(3) The system may be divided functionally into three parts:

(a) **Guidance information —** localizer, glide slope

(b) **Range information —** marker beacon, DME

(c) **Visual information —** approach lights, touchdown and centerline lights, runway lights

(4) Compass locators located at the Outer Marker (OM) or Middle Marker (MM) may be substituted for marker beacons. DME, when specified in the procedure, may be substituted for the OM.

(5) Where a complete ILS system is installed on each end of a runway; (i.e. the approach end of Runway 4 and the approach end of Runway 22) the ILS systems are not in service simultaneously.

b. LOCALIZER

(1) The localizer transmitter operates on one of 40 ILS channels within the frequency range of 108.10 to 111.95 MHz. Signals provide the pilot with course guidance to the runway centerline.

(2) The approach course of the localizer is called the front course and is used with other functional parts, e.g., glide slope, marker beacons, etc. The localizer signal is transmitted at the far end of the runway. It is adjusted for a course width of (full scale fly-left to a full scale fly-right) of 700 feet at the runway threshold.

(3) The course line along the extended centerline of a runway, in the opposite direction to the front course is called the back course.

> *CAUTION:* Unless the aircraft's ILS equipment includes reverse sensing capability, when flying inbound on the back course it is necessary to steer the aircraft in the direction opposite the needle deflection when making corrections from off-course to on-course. This "flying away from the needle" is also required when flying outbound on the front course of the localizer. DO NOT USE BACK COURSE SIGNALS for approach unless a BACK COURSE APPROACH PROCEDURE is published for that particular runway and the approach is authorized by ATC.

(4) Identification is in International Morse Code and consists of a three-letter identifier preceded by the letter I (..) transmitted on the localizer frequency.

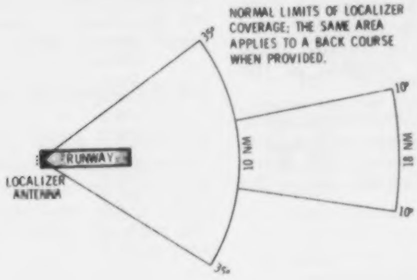
EXAMPLE:

I-DIA

(5) The localizer provides course guidance throughout the descent path to the runway threshold from a distance of 18 NM from the antenna between an altitude of 1,000 feet above the highest terrain along the course line and 4,500 feet above the elevation of the antenna site. Proper off-course indications are provided throughout the following angular areas of the operational service volume:

(a) To 10 degrees either side of the course along a radius of 18 NM from the antenna, and

(b) From 10 to 35 degrees either side of the course along a radius of 10 NM.


NORMAL LIMITS OF LOCALIZER COVERAGE; THE SAME AREA APPLIES TO A BACK COURSE WHEN PROVIDED.
35°
10°
10 NM
18 NM
10°
RUNWAY
LOCALIZER ANTENNA
35°

(6) Unreliable signals may be received outside these areas.

c. LOCALIZER—TYPE DIRECTIONAL AID

(1) The Localizer-type Directional Aid (LDA) is of comparable use and accuracy to a localizer but is not part of a complete ILS. The LDA course usually provides a more precise approach course than the similar Simplified Directional Facility (SDF) installation, which may have a course width of 6 or 12 degrees. The LDA is not aligned with the runway. Straight-in minimums may be published where alignment does not exceed 30 degrees between the course and runway. Circling minimums only are published where this alignment exceeds 30 degrees.

d. GLIDE SLOPE/GLIDE PATH

(1) The UHF glide slope transmitter, operating on one of the 40 ILS channels within the frequency range 329.15 MHz, to 335.00 MHz radiates its signals in the direction of the localizer front course. The term "glide path" means that portion of the glide slope that intersects the localizer.

CAUTION: False glide slope signals may exist in the area of the localizer back course approach which can cause the glide slope flag alarm to disappear and present unreliable glide slope information. Disregard all glide slope signal indications when making a localizer back course approach unless a glide slope is specified on the approach and landing chart.

(2) The glide slope transmitter is located between 750 feet and 1,250 feet from the approach end of the runway (down the runway) and offset 250 to 650 feet from the runway centerline. It transmits a glide path beam 1.4 degrees wide. The signal provides descent information for navigation down to the lowest authorized decision height (DH) specified in the approved ILS approach procedure. The glidepath may not be suitable for navigation below the lowest authorized DH and any reference to glidepath indications below that height must be supplemented by visual reference to the runway environment. Glidepaths with no published DH are usable to runway threshold.

(3) The glide path projection angle is normally adjusted to 3 degrees above horizontal so that it intersects the MM at about 200 feet and the OM at about 1,400 feet above the runway elevation. The glide slope is normally usable to the distance of 10 NM. However, at some locations, the glide slope has been certified for an extended service volume which exceeds 10 NM.

(4) Pilots must be alert when approaching the glidepath interception. False courses and reverse sensing will occur at angles considerably greater than the published path.

(5) Make every effort to remain on the indicated glide path (reference: FAR 91.87(d)(2)). Exercise caution: avoid flying below the glide path to assure obstacle/terrain clearance is maintained.

(6) The published glide slope threshold crossing height (TCH) *DOES NOT* represent the height of the actual glide path on course indication above the runway threshold. It is used as a reference for planning purposes which represents the height above the runway threshold that an aircraft's glide slope antenna should be, if that aircraft remains on a trajectory formed by the four-mile-to-middle marker glidepath segment.

(7) Pilots must be aware of the vertical height between the aircraft's glide slope antenna and the main gear in the landing configuration and, at the DH, plan to adjust the descent angle accordingly if the published TCH indicates the wheel crossing height over the runway threshold may not be satisfactory. Tests indicate a comfortable wheel crossing height is approximately 20 to 30 feet, depending on the type of aircraft.

e. DISTANCE MEASURING EQUIPMENT (DME)

(1) When installed with the ILS and specified in the approach procedure, DME may be used:

(a) In lieu of the OM.

(b) As a back course (BC) final approach fix (FAF).

(c) To establish other fixes on the localizer course.

(2) In some cases, DME from a separate facility may be used within Terminal Instrument Procedures (TERPS) limitations:

(a) To provide ARC initial approach segments.

(b) As a FAF for BC approaches.

(c) As a substitute for the OM.

f. MARKER BEACON

(1) ILS marker beacons have a rated power output of 3 watts or less and an antenna array designed to produce a elliptical pattern with dimensions, at 1,000 feet above the antenna, of approximately 2,400 feet in width and 4,200 elliptical pattern with dimensions, at 1,000 feet above the antenna, of approximately 2,400 feet in width and 4,200 feet in length. Airborne marker beacon receivers with a selective sensitivity feature should always be operated in the "low" sensitivity position for proper reception of ILS marker beacons.

(2) Ordinarily, there are two marker beacons associated with an ILS, the OM and MM. Locatons with a Category II and III ILS also have an inner marker (IM). When an aircraft passes over a marker, the pilot will receive the following indications:

MARKER	CODE	LIGHT
OM	— — —	BLUE
MM	○ — ○ —	AMBER
IM	○ ○ ○ ○	WHITE
BC	○ ○ ○ ○	WHITE

(a) The OM normally indicates a position at which an aircraft at the appropriate altitude on the localizer course will intercept the ILS glide path.

(b) The MM indicates a position approximately 3,500 feet from the landing threshold. This is also the position where an aircraft on the glide path will be at an altitude of approximately 200 feet above the elevation of the touchdown zone.

(c) The inner marker (IM) will indicate a point at which an aircraft is at a designated decision height (DH) on the glide path between the MM and landing threshold.

(3) A back course marker normally indicates the ILS back course final approach fix where approach descent is commenced.

g. COMPASS LOCATOR

(1) Compass locator transmitters are often situated at the MM and OM sites. The transmitters have a power of less than 25 watts, a range of at least 15 miles and operate between 190 and 535 kHz. At some locations, higher powered radio beacons, up to 400 watts, are used as OM compass locators. These generally carry Transcribed Weather Broadcast (TWEB) information.

(2) Compass locators transmit two letter identification groups. The outer locator transmits the first two letters of the localizer identification group, and the middle locator transmits the last two letters of the localizer identification group.

h. ILS FREQUENCY

(1) The following frequency pairs are allocated for ILS.

Localizer MHz	Glide Slope	
108.10	334.70	
108.15	334.55	
108.3	334.10	
108.35	333.95	
108.5	329.90	
108.55	329.75	
108.7	330.50	
108.75	330.35	
108.9	329.30	
108.95	329.15	
109.1	331.40	
109.15	331.25	
109.3	332.00	
109.35	331.85	
109.50	332.60	
109.55	332.45	
109.70	333.20	
109.75	333.05	
109.90	333.80	
109.95	333.65	
110.1	334.40	
110.15	334.25	
110.3	335.00	
110.35	334.85	
110.5	329.60	
110.55	329.45	
110.70	330.20	
110.75	330.05	
110.90	330.80	
110.95	330.65	
111.10	331.70	
111.15	331.55	
111.30	332.30	
111.35	332.15	
111.50	332.9	
111.55	332.75	
111.70	333.5	
111.75	333.35	
111.90	331.1	
111.95	330.95	

i. ILS MINIMUMS

(1) The lowest authorized ILS minimums, with all required ground and airborne systems components operative, are

(a) Category I - Decision Height (DH) 200 feet and Runway Visual Range (RVR) 2,400 feet (with touchdown zone and centerline lighting, RVR 1800 Category A, B, C; RVR 2000 Category D).

(b) Category II - DH 100 feet and RVR 1,200 feet.

(c) Category IIIA - RVR 700 feet.

NOTE— Special authorization and equipment are required for Category II and IIIA.

j. INOPERATIVE ILS COMPONENTS

(1) Inoperative localizer: When the localizer fails, an ILS approach is not authorized.

(2) Inoperative glide slope: When the glide slope fails, the ILS reverts to a nonprecision localizer approach.

NOTE— Refer to the Inoperative Component Table in the U.S. Government IAPs publications, Supplementary Information Section, for adjustments to minimums due to inoperative airborne or ground system equipment.

k. ILS COURSE DISTORTION

(1) All pilots should be aware that disturbances to ILS localizer and glide slope courses may occur when surface vehicles or aircraft are operated near the localizer or glide slope antennas. Most ILS installations are subject to signal interference by either surface vehicles, aircraft or both. ILS CRITICAL AREAS are established near each localizer and glide slope antenna.

(2) ATC issues control instructions to avoid interfering operations within ILS critical areas at controlled airports during the hours the Airport Traffic Control Tower (ATCT) is in operations as follows:

(a) Weather Conditions - Less than ceiling 800 feet and/or visibility 2 miles.

(i) LOCALIZER CRITICAL AREA - Except for aircraft that land, exit a runway, depart or miss approach, vehicles and aircraft are not authorized in or over the critical area when an arriving aircraft is between the ILS final approach fix and the airport. Additionally, when the ceiling is less than 200 feet and/or the visibility is RVR 2,000 or less, vehicle and aircraft operations in or over the area are not authorized when an arriving aircraft is inside the ILS MM.

(ii) GLIDE SLOPE CRITICAL AREA - Vehicles and aircraft are not authorized in the area when an arriving aircraft is between the ILS final approach fix and the airport unless the aircraft has reported the airport in sight and is circling or side stepping to land on a runway other than the ILS runway.

(3) Aircraft holding below 5000 feet between the outer marker and the airport may cause localizer signal variations for aircraft conducting the ILS Approach. Accordingly, such holding is not authorized when weather or visibility conditions are less than ceiling 800 feet and/or visibility 2 miles.

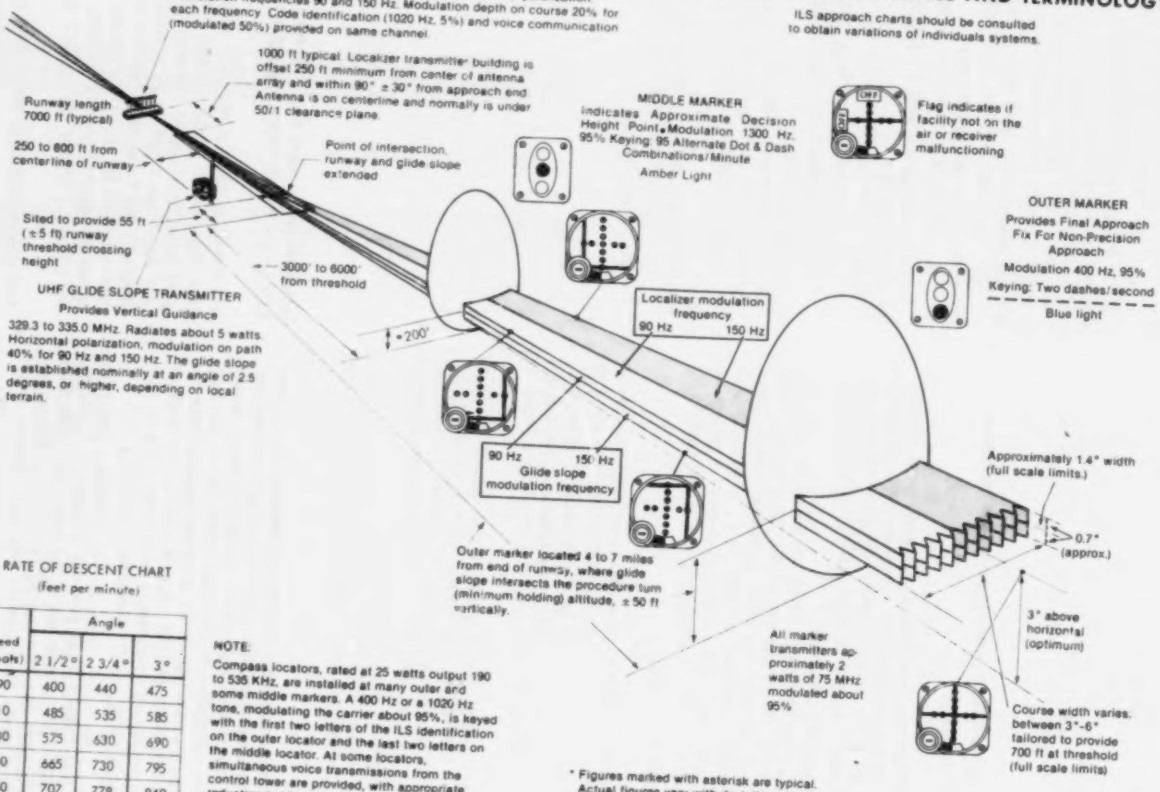
(4) Pilots are cautioned that vehicular traffic not subject to ATC may cause momentary deviation to ILS course or glide slope signals. Also, critical areas are not protected at uncontrolled airports or at airports with an operating control tower when weather or visibility conditions are above those requiring protective measures. Aircraft conducting coupled or autoland operations should be especially alert in monitoring automatic flight control systems.

ILS

[FAA INSTRUMENT LANDING SYSTEM]

STANDARD CHARACTERISTICS AND TERMINOLOGY

ILS approach charts should be consulted to obtain variations of individuals systems.



VHF LOCALIZER

Provides Horizontal Guidance

108.10 to 111.95 MHz. Radiates about 100 watts. Horizontal polarization. Modulation frequencies 90 and 150 Hz. Modulation depth on course 20% for each frequency. Code identification (1020 Hz, 5%) and voice communication (modulated 50%) provided on same channel.

1000 ft typical. Localizer transmitter building is offset 250 ft minimum from center of antenna array and within 90° ± 30° from approach end. Antenna is on centerline and normally is under 50/1 clearance plane.

Runway length 7000 ft (typical)

250 to 600 ft from centerline of runway

Point of intersection, runway and glide slope extended

Sited to provide 55 ft (±5 ft) runway threshold crossing height

3000' to 6000' from threshold

UHF GLIDE SLOPE TRANSMITTER

Provides Vertical Guidance

329.3 to 335.0 MHz. Radiates about 5 watts. Horizontal polarization, modulation on path 40% for 90 Hz and 150 Hz. The glide slope is established nominally at an angle of 2.5 degrees, or higher, depending on local terrain.

MIDDLE MARKER

Indicates Approximate Decision Height Point. Modulation 1300 Hz, 95% Keying: 95 Alternate Dot & Dash Combinations/Minute

Amber Light

Flag indicates if facility not on the air or receiver malfunctioning

OUTER MARKER

Provides Final Approach Fix For Non-Precision Approach

Modulation 400 Hz, 95%

Keying: Two dashes/second

— — — — — — — —

Blue light

Outer marker located 4 to 7 miles from end of runway, where glide slope intersects the procedure turn (minimum holding) altitude, ± 50 ft vertically.

All marker transmitters approximately 2 watts of 75 MHz modulated about 95%

Approximately 1.4° width (full scale limits.)

3° above horizontal (optimum)

Course width varies between 3°-6° tailored to provide 700 ft at threshold (full scale limits)

•200'
Localizer modulation frequency
90 Hz
150 Hz
90 Hz
150 Hz
Glide slope modulation frequency
0.7° (approx.)
UHF

RATE OF DESCENT CHART

(feet per minute)

Speed (Knots)	Angle		
	2 1/2°	2 3/4°	3°
90	400	440	475
110	485	535	585
130	575	630	690
150	665	730	795
160	707	778	849

NOTE:

Compass locators, rated at 25 watts output 190 to 535 KHz, are installed at many outer and some middle markers. A 400 Hz or a 1020 Hz tone, modulating the carrier about 95%, is keyed with the first two letters of the ILS identification on the outer locator and the last two letters on the middle locator. At some locators, simultaneous voice transmissions from the control tower are provided, with appropriate reduction in identification percentage.

* Figures marked with asterisk are typical. Actual figures vary with deviations in distances to markers, glide angles and localizer widths.

(b) Weather Conditions - At or above ceiling 800 feet and/or visibility 2 miles.

(i) No critical area protective action is provided under these conditions

(ii) If an aircraft advises the TOWER that an AUTOLAND or COUPLED approach will be conducted, an advisory will be promptly issued if a vehicle or aircraft will be in or over a critical area when the arriving aircraft is inside the ILS MM.

EXAMPLE:

GLIDE SLOPE SIGNAL NOT PROTECTED.

13. SIMPLIFIED DIRECTIONAL FACILITY (SDF)

a. The SDF provides a final approach course similar to that of the ILS localizer. It does not provide glide slope information. A clear understanding of the ILS localizer and the additional factors listed below completely describe the operational characteristics and use of the SDF.

b. The SDF transmits signals within the range of 108.10 to 111.95 MHz.

c. The approach techniques and procedures used in an SDF instrument approach are essentially the same as those employed in executing a standard localizer approach except the SDF course may not be aligned with the runway and the course may be wider, resulting in less precision.

d. Usable off-course indications are limited to 35 degrees either side of the course centerline. Instrument indications received beyond 35 degrees should be disregarded.

e. The SDF antenna may be offset from the runway centerline. Because of this, the angle of convergence between the final approach course and the runway bearing should be determined by reference to the instrument approach procedure chart. This angle is generally not more than 3 degrees. However, it should be noted that inasmuch as the approach course originates at the antenna site, an approach which is continued beyond the runway threshold will lead the aircraft to the SDF offset position rather than along the runway centerline.

f. The SDF signal is fixed at either 6 degrees or 12 degrees as necessary to provide maximum flyability and optimum course quality.

g. Identification consists of a three-letter identifier transmitted in Morse Code on the SDF frequency. The appropriate instrument approach chart will indicate the identifier used at a particular airport.

14. MICROWAVE LANDING SYSTEM (MLS)

a. GENERAL

(1) The MLS provides precision navigation guidance for exact alignment and descent of aircraft on approach to and landing on a runway. It provides azimuth and elevation angle guidance and range information—all of which is interpreted by the aircraft receiver to determine the aircraft's position. The MLS azimuth transmitter is located about 1,000 feet beyond the stop end of the runway, and the MLS elevation transmitter is located to the side of the runway near the approach threshold. The Precision DME, which provides range information, is normally collocated with the azimuth transmitter.

(2) Both lateral and vertical MLS guidance may be displayed on conventional course deviation indicators or incorporated into multipurpose cockpit displays. Range information can be displayed by conventional DME indicators and also incorporated into multipurpose displays.

(3) The MLS will initially supplement and eventually replace ILS as the standard landing system in the United States for both civil and military use—and also for international civil aviation. The MLS transition plan assures duplicate ILS and MLS facilities where needed to protect current users of ILS. At international airports ILS service is protected to the year 1995.

(4) The system may be divided functionally into five parts:

(a) Approach azimuth angle guidance.

(b) Back azimuth angle guidance.

(c) Approach elevation angle guidance.

(d) Range guidance.

(e) Data communications.

(5) The *standard configuration* of the MLS ground equipment includes:

(a). An approach azimuth station to perform functions (a) and (e) above. In addition to providing azimuth navigation guidance, the azimuth station also transmits basic data which consists of information that is associated directly with the operation of the landing system, as well as advisory data on the performance level of the ground equipment.

(b) An approach elevation station to perform function (c) above.

(c) Precision Distance Measuring Equipment (DME/P) to perform function (d) above. The DME/P provides continuous range information that is compatible with standard navigation DME but has improved accuracy and additional channel capabilities.

(6) MLS Expansion Capabilities — The standard MLS configuration can be expanded by addition of one or more of the following functions or characteristic improvements:

(a) Back azimuth — To provide lateral guidance for missed approach and departure navigation.

(b) Auxiliary data transmissions — To provide *additional* data, including refined airborne positioning, meteorological information, runway status, and other supplementary information.

(c) Larger proportional guidance.

(7) MLS identification is a four-character alphabetic designation starting with the letter M. This designation is transmitted in International Morse Code at least six times per minute by the approach azimuth (and back azimuth) ground equipment.

b. APPROACH AZIMUTH GUIDANCE

(1) The azimuth station transmits MLS angle (and data) on one of the 200 MLS channels within the C-band frequency range of 5031 to 5091 MHz. See Table 1 for MLS angle and data channeling, and Table 2 for the DME.

(2) The equipment is normally located about 1,000 feet beyond the stop end of the runway, but there is considerable flexibility in selecting sites. For example, for heliport operations the azimuth transmitter can be collocated with the elevation transmitter.

(3) The azimuth coverage (see Figure 1) extends:

(a) Laterally, at least 40 degrees on either side of the runway.

(b) In elevation, up to an angle of 15 degrees — and to at least 20,000 feet.

(c) In range, to a distance of at least 20 NM.

c. BACK AZIMUTH GUIDANCE (See Figure 1)

(1) The back azimuth transmitter is essentially the same as the approach azimuth transmitter. However, the equipment transmits at a somewhat lower data rate because the guidance accuracy requirements are not as stringent as for the landing approach. The equipment operates on the same frequency as the approach azimuth but at a different time in the transmission sequence.

(2) The equipment is normally located about 1,000 feet in front of the approach end of the runway. On runways that have MLS service on both ends (e.g., Runway 9 and 27), the azimuth equipment can be switched in their operation from the approach azimuth to the back azimuth and vice versa, and thereby reduce the amount of equipment required.

(3) The back azimuth provides coverage as follows:

(a) Laterally, at least 40 degrees on either side of the runway.

(b) In elevation, up to an angle of 15 degrees.

(c) In range, to a distance of at least 7 NM from the runway stop end.

NOTE— The actual coverage will normally be the same as for the approach azimuth.

d. ELEVATION GUIDANCE (See Figure 1)

(1) The elevation station transmits its guidance signals on the same carrier frequency as the azimuth station. A single frequency is time-shared between all angle and data functions.

(2) The elevation transmitter is normally located about 400 feet on either side of the runway between runway threshold and the touchdown zone.

(3) Elevation coverage is provided in the approach region throughout the same volume of airspace as the azimuth guidance signals, namely:

(a) In elevation, to at least +15 degrees.

(b) Laterally, 40 degrees on either side of the runway.

(c) In range, to a distance of at least 20 NM.

e. RANGE GUIDANCE

(1) The MLS Precision Distance Measuring Equipment (DME/P) is the same in function as the navigation DME described in PARA. 7, but there are some technical differences. It consists of a beacon transponder that operates in the frequency band 962 to 1105 MHz. It responds to a beacon interrogation made by an aircraft interrogator. The main change with the MLS DME/P is that the accuracy has been improved so as to be consistent with the accuracy provided by the MLS azimuth and elevation stations.

(2) In operation, a DME/P channel will be paired with the azimuth and elevation channel when the selection of a particular MLS is made by the pilot. A complete listing of the 200 paired channels of the DME/P with the angle functions is contained in FAA Standard 022 (MLS Interoperability and Performance Requirements). For illustrative purposes the first page is shown in Table 2.

(3) The DME/P is an integral part of the MLS and will be installed at all MLS facilities unless a waiver is obtained. It is intended that this will occur infrequently — and only at outlying, low density airports where marker beacons or compass locators are already in place at the runway to be served.

f. DATA COMMUNICATIONS

(1) The data transmission can include both basic and auxiliary data words. All MLS facilities will transmit basic data. In the future some airports, including most high density airports, will also transmit auxiliary data.

(2) Coverage limits — MLS data are transmitted throughout the azimuth (and back azimuth when provided) coverage sectors.

(3) Basic data content — Representative data include:

(a) Station identification.

(b) Surveyed locations of azimuth, elevation and DME/P stations (for MLS receiver processing functions).

(c) Ground equipment performance level.

(d) DME/P channel and status.

(4) Auxiliary data content — Representative data include:

(a) 3-D locations of MLS equipment.

(b) Waypoint coordinates.

(c) Runway conditions.

(d) Weather (e.g., RVR, ceiling, altimeter setting, wind, wake vortex, wind shear).

g. SUMMARY

(1) Accuracy. The MLS provides precision three-dimensional navigation guidance — guidance that is accurate enough for all approach and landing maneuvers.

(2) Coverage. The above accuracy is provided throughout the coverage volumes shown in Figure 1.

(3) Environment. The system has low susceptibility to interference from weather conditions and airport ground traffic — and is easy to site on the airport.

(4) Channels. MLS has 200 channels — enough for any foreseeable future need.

(5) Data. The MLS transmits ground-air data messages associated with system operation.

(6) Range information. Continuous range information is provided with an accuracy of about 100 feet.

(7) Operational flexibility. The MLS has the capability to fulfill a variety of needs in the transition, approach, landing, missed approach and departure phases of flight. For example: Curved and segmented approaches; selectable glide path angles; accurate 3-D positioning of the aircraft in space; and the establishment of boundaries to ensure clearance from obstructions in the terminal area. While many of these capabilities are available to any MLS-equipped aircraft, the more sophisticated capabilities (such as curved and segmented approaches) are dependent upon the particular capabilities of the airborne equipment.

Table 1. MLS Channeling

(Azimuth, Elevation, & Data)

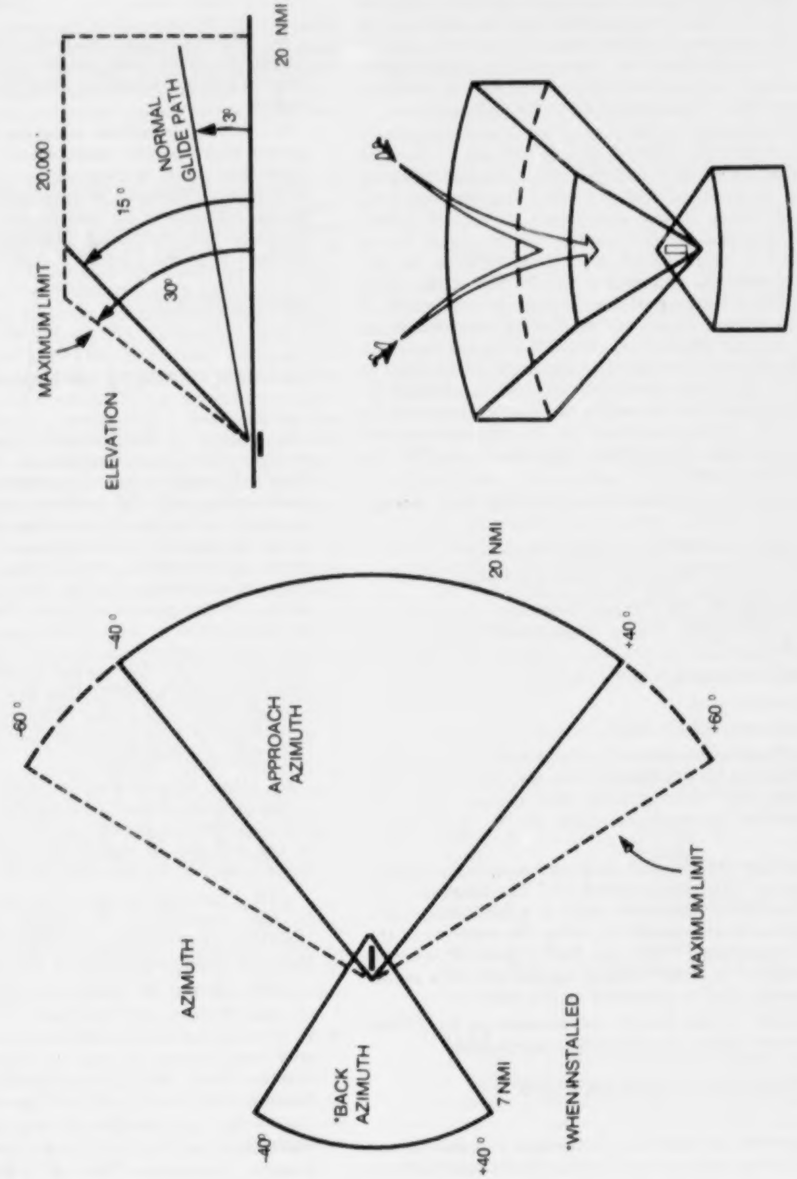
CHANNEL NUMBER	FREQUENCY (MHz)	CHANNEL NUMBER	FREQUENCY (MHz)	CHANNEL NUMBER	FREQUENCY (MHz)	CHANNEL NUMBER	FREQUENCY (MHz)	CHANNEL NUMBER	FREQUENCY (MHz)
500	5031.0	540	5043.0	580	5055.0	620	5067.0	660	5079.0
501	5031.3	.	.	.	.	.	.	.	.
502	5031.6	.	.	.	.	.	.	.	.
503	5031.9	.	.	.	.	.	.	.	.
504	5032.2	.	.	.	.	.	.	.	.
505	5032.5	545	5044.5	585	5056.5	625	5068.5	665	5080.5
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
510	5034.0	550	5046.0	590	5058.0	630	5070.0	670	5082.0
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
515	5035.5	555	5047.5	595	5059.5	635	5071.5	675	5083.5
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
520	5037.0	560	5049.0	600	5061.0	640	5073.0	680	5085.0
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
525	5038.5	565	5050.5	605	5062.5	645	5074.5	685	5086.5
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
530	5040.0	570	5052.0	610	5064.0	650	5076.0	690	5088.0
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
535	5041.5	575	5053.5	615	5065.5	655	5077.5	695	5089.5
.	.	.	.	.	.	.	.	696	5089.8
.	.	.	.	.	.	.	.	697	5090.1
.	.	.	.	.	.	.	.	698	5090.4
.	.	.	.	.	.	.	.	699	5090.7

Table 2. DME/P Channels, Frequencies, and Pairings

DME CHANNEL (NUMBER)	VHF CHANNEL (MHz)	C-BAND CHANNEL (MHz)	ANGLE CHANNEL (NUMBER)	INTERROGATOR FREQUENCY (MHz)	NON-PRECISION INTERROGATOR PULSE CODE (USEC)	PRECISION INTERROGATOR PULSE CODE (USEC)	TRANSPONDER FREQUENCY (MHz)	TRAN PONDI PULS CODI (USE
1X				1025	12		962	
1Y				1025	36		1088	
2X				1026	12		963	
2Y				1026	36		1089	
3X				1027	12		964	
3Y				1027	36		1090	
4X				1028	12		965	
4Y				1028	36		1091	
5X				1029	12		966	
5Y				1029	36		1092	
6X				1030	12		967	
6Y				1030	36		1093	
7X				1031	12		968	
7Y				1031	36		1094	
8X				1032	12		969	
8Y				1032	36		1095	
9X				1033	12		970	
9Y				1033	36		1096	
10X				1034	12		971	
10Y				1034	36		1097	
11X				1035	12		972	
11Y				1035	36		1098	
12X				1036	12		973	
12Y				1036	36		1099	
13X				1037	12		974	
13Y				1037	36		1100	
14X				1038	12		975	
14Y				1038	36		1101	
15X				1039	12		976	
15Y				1039	36		1102	
16X				1040	12		977	
16Y				1040	36		1103	
17X	108.00	-	-	1041	12	-	978	
17Y	108.05	5043.00	540	1041	36	42	1104	
17Z	-	5043.30	541	1041	21	27	1104	
18X	108.10	5031.00	500	1042	12	18	979	
18W	-	5031.30	501	1042	24	33	979	
18Y	108.15	5043.60	542	1042	36	42	1105	
18Z	-	5043.90	543	1042	21	27	1105	
19X	108.20	-	-	1043	12	-	980	

Figure 1.

COVERAGE VOLUMES


ELEVATION
MAXIMUM LIMIT
30°
15°
20,000'
NORMAL GLIDE PATH
3°
20 NMI
AZIMUTH
-60°
-40°
APPROACH AZIMUTH
20 NMI
+40°
+60°
MAXIMUM LIMIT
*BACK AZIMUTH
-40°
+40°
7 NMI
*WHEN INSTALLED

15. INTERIM STANDARD MICROWAVE LANDING SYSTEM (ISMLS)

a. The ISMLS is designed to provide approach information similar to the ILS for an aircraft on final approach to a runway. The system provides both lateral and vertical guidance which is displayed on a conventional course deviation indicator or approach horizon. Operational performance and coverage areas are similar to the ILS system.

b. ISMLS operates in the C-band microwave frequency range (about 5000 MHz). ISMLS signals will not be received by unmodified VHF/UHF ILS receivers. Aircraft utilizing ISMLS must be equipped with a C-band receiving antenna in addition to other special equipment mentioned below. The C-band antenna limits reception of the signal to an angle of about 50 degrees from the inbound course. An aircraft so equipped will not receive the ISMLS signal until flying a magnetic heading within 50 degrees either side of the inbound course. Because of this, ISMLS procedures are designed to restrict the use of the ISMLS signal until the aircraft is in position for the final approach. Transition to the ISMLS, holding and procedure turns at the ISMLS facility must be predicated on other navigation aids such as NDB, VOR, etc. Once established on the approach course inbound, the system can be flown the same as an ILS. No back course is provided.

c. The ISMLS consists of the following basic components:

(1) C-Band (5000 MHz-5030 MHz) localizer.

(2) C-Band (5220 MHz-5250 MHz) glide path.

(3) VHF marker beacons (75 MHz).

(4) A VHF/UHF ILS receiver modified to recieve ISMLS signals.

(5) C-Band antenna.

(6) Converter unit.

(7) A Microwave/ILS Mode Control.

d. Identification consists of a three letter Morse Code identifier preceded by the Morse Code for "M" (- -) (e.g., M—STP). The "M" distinguishes this system from ILS which is preceded by the Morse Code for "I" (..) (e.g., I-STP).

e. Approaches published in conjunction with the ISMLS are identified as "MLS Rwy—(Interim)." The frequency displayed on the ISMLS approach chart is a VHF frequency. ISMLS frequencies are tuned by setting the receiver to the listed VHF frequencies. When the ISMLS mode is selected, receivers modified to accept ISMLS signals receive a paired C-band frequency that is processed by the receiver.

> *CAUTION:* Pilots should not attempt to fly ISMLS procedures unless the aircraft is so equipped.

16. MAINTENANCE OF FAA NAVAIDS

During periods of routine or emergency maintenance, coded identification (or code and voice, where applicable) is removed from certain FAA NAVAIDs. Removal of identification serves as a warning to pilots that the facility is officially off the air for tune-up or repair and may be unreliable even though intermittent or constant signals are received.

NOTE- During periods of maintenance VHF ranges may radiate a T-E-S-T code (— ● ●●● —).

17. NAVAIDS WITH VOICE

a. Voice equipped en route radio navigational aids are under the operational control of either an FAA FSS or an approach control facility. Most NAVAIDs are remotely operated.

b. Unless otherwise noted on the chart, all radio navigation aids operate continuously except during interruptions for voice transmissions on the same frequencies where simultaneous transmission is not available, and during shutdowns for maintenance. Hours of operation of facilities not operating continuously are annotated on charts and in the Airport/Facility Directory.

18. RESERVED

19. USER REPORTS ON NAVAID PERFORMANCE

a. Users of the National Airspace System (NAS) can render valuable assistance in the early correction of NAVAID malfunctions by reporting their observations of undesirable NAVAID performance. Although the NAVAID is monitored by electronic detectors within the equipment or in the field of radiation near the antenna, adverse effects of electronic interference, new obstructions or changes in terrain near the NAVAID can exist without detection by the ground monitors. Some of the characteristics of malfunction or deteriorating performance which should be reported are: erratic course or bearing indications; intermittent, or full, flag alarm; garbled, missing or obviously improper coded identification; poor quality communications reception; or, in the case of frequency interference, an audible hum or tone accompanying radio communications or NAVAID identification.

b. User reports should identify the NAVAID, location of the aircraft, time of the observation and type of aircraft and describe the condition observed; the type of receivers in use will also be useful information. User reports can be made in any of the following ways:

(1) Immediate report by direct radio communication to the controlling Air Route Traffic Control Center (ARTCC), Control Tower, or FSS. This method will provide the most timely resolution of the reported condition.

(2) Report by telephone to the nearest FAA facility.

(3) Report by FAA Form 8000-7, Safety Improvement Report. This is a self addressed, postage-paid card designed with this purpose in mind. A supply of these cards may be found at FAA FSSs, General Aviation District Offices and General Aviation Fixed Base Operations.

c. In complex aircraft radio installations involving more than one receiver, there are many combinations of possible interference between units. This interference can cause either erroneous navigation indications, or complete or partial blanking out of the communications. Pilots should be familiar enough with the radio installation of the particular airplanes they fly to recognize this type of interference.

20. LORAN

a. LORAN-A service has been terminated in the U.S. coastal confluence region.

b. LORAN-C was developed to provide the Department of Defense with a radio navigation capability having longer range and much greater accuracy than its predecessor, LORAN-A. It was subsequently selected as the U.S. Government provided radio navigation system for civil marine use in the U.S. coastal areas.

c. Operation

LORAN-C is a pulsed, hyperbolic system, operating in the 90-110 kHz frequency band. The system is based upon measurement of the difference in time of arrival of pulses of radio-frequency energy radiated by a group, or chain of transmitters which are separated by hundreds of miles. Within a chain, one station is designated as the Master station (M), and the other stations are designated as Secondary stations, Whiskey (W), X-ray (X), Yankee (Y), and Zulu (Z). Signals transmitted from the Secondary stations are synchronized with those from the Master station. The measurement of a time-difference (TD) is made by a receiver that achieves accuracy by comparing a zero crossing of a specified radio- frequency cycle within the pulses received from the Master and Secondary stations of a chain. Only groundwave signals are used for air navigation in the National Airspace System. Within the groundwave range, LORAN-C will provide the user, who uses an adequate receiver, with predictable accuracy of 0.25 nautical miles (2 drms) or better. All accuracy is dependent on the user's location within the signal coverage area of the chain of stations.

d. Signal coverage

Expansion of the LORAN-C system to meet the requirement for the U.S. coastal waters of the conterminous 48 states and southern Alaska was completed in the late 1979. Stations have been built to provide service to the U.S. east and west coasts, the Gulf of Mexico, the Gulf of Alaska and Aleutians, and the Great Lakes. The coastal transmitters also provide inland coverage over about two-thirds of the area of the 48 states and over the southwestern portion of Alaska. Missing, from an aviation view point, is signal coverage over the mid-continent area.

e. Aviation uses

LORAN-C has been approved as an en route IFR navigation aid under provisions of Advisory Circular 20-121, "Airworthiness Approval of Airborne LORAN-C Systems for Use in the U.S. National Airspace System," August 23, 1984. The first LORAN-C guided nonprecision approach was made at Bedford, Massachussetts, on November 4, 1985, as part of an early implementation project established by the FAA in close cooperation with the National Association of State Aviation Officials. Until operational signal monitor receivers, similar in function to those used in the limited implementation project, are installed in existing coverage areas, the number of approved nonprecision approach procedures will be limited.

f. Planned expansion

Current plans are to procure and install signal monitors in existing signal coverage areas with completion expected by mid-1988. The monitors will serve two functions: (1) they will provide immediate advisories on signal status to air traffic for use in granting approach clearances, and (2) they will be the source of calibration values that will be published on approach charts. The calibration values will remove most of the seasonal error that could cause LORAN-C accuracy to be worse than approach accuracy requirements. The mid-continent area will be provided with signal coverage after the planned installation of additional transmitters; completion of the installation is expected in 1989. In addition to the transmitters, signal monitors will be installed in the mid-continent to support nonprecision approaches.

21. OMEGA AND OMEGA/VLF NAVIGATION SYSTEMS

a. OMEGA

(1) OMEGA is a network of eight transmitting stations located throughout the world to provide worldwide signal coverage. These stations transmit in the Very Low Frequency (VLF) band. Because of the low frequency, the signals are receivable to ranges of thousands of miles. The stations are located in Norway, Liberia, Hawaii, North Dakota (USA), La Reunion, Argentina, Australia, and Japan.

(2) Presently each station transmits on four basic navigational frequencies: 10.2 kHz, 11.05 kHz, 11.3 kHz, and 13.6 kHz, in sequenced format. This time sequenced format prevents interstation signal interference. With eight stations and a silent .2-second interval between each transmission, the entire cycle repeats every 10 seconds.

(3) In addition to the four basic navigational frequencies, each station transmits a unique navigation frequency. An OMEGA station is said to be operating in full format when the station transmits on the basic frequencies plus the unique frequency. Unique frequencies are presently assigned as follows:

STATION	LOCATION	FREQUENCY
Station A	Norway	12.1 kHz
Station B	Liberia	12.0 kHz
Station C	Hawaii	11.8 kHz
Station D	North Dakota	13.1 kHz
Station E	La Reunion	12.3 kHz
Station F	Argentina	12.9 kHz
Station G	Australia	13.0 kHz
Station H	Japan	12.8 kHz

b. VLF

(1) The U.S. Navy operates a communications system in the VLF band. The stations are located worldwide and transmit at powers of 500-1000 kW. Some airborne OMEGA receivers have the capability to receive and process these VLF signals for navigation in addition to OMEGA signals. The VLF stations generally used for navigation are located in Australia, Japan, England, Hawaii and in the U.S. in Maine, Washington and Maryland.

(2) Although the Navy does not object to the use of VLF communications signals for navigation, the system is not dedicated to navigation. Signal format, transmission,

and other parameters of the VLF system are subject to change at the Navy's discretion. The VLF communications stations are individually shut down for scheduled maintenance for a few hours each week. Regular NOTAM service regarding the VLF system or station status is not available. However, the Naval Observatory provides a taped message concerning phase differences, phase values, and shutdown information for both the VLF communications network and the OMEGA system (phone 202-653-1757).

c. Operational Use of OMEGA and OMEGA/VLF

(1) The OMEGA navigation network is capable of providing consistent fixing information to an accuracy of plus or minus 2 NM depending upon the level of sophistication of the receiver/processing system. OMEGA signals are affected by propagation variables which may degrade fix accuracy. These variables include daily variation of phase velocity, polar cap absorption, and sudden solar activity. Daily compensation for variation within the receiver/processor, or occasional excessive solar activity and its effect on OMEGA, cannot be accurately forecast or anticipated. If an unusual amount of solar activity disturbs the OMEGA signal enlargement paths to any extent, the U.S. Coast Guard advises the FAA and an appropriate NOTAM is sent.

(2) At 16 minutes past each hour, WWV (Fort Collins, Colorado) broadcasts a message concerning the status of each OMEGA station, signal irregularities, and other information concerning OMEGA. At 47 minutes past each hour, WWVH (Hawaii) broadcasts similar information. The U.S. Coast Guard provides a taped OMEGA status report (202-245-0298). NOTAMS concerning OMEGA are available through any FSS. OMEGA NOTAMs should be requested by OMEGA station name.

(3) The FAA has recognized OMEGA and OMEGA/VLF systems as an additional means of en route IFR navigation in the conterminous United States and Alaska when approved in accordance with FAA guidance information. Use of OMEGA or OMEGA/VLF requires that all navigation equipment otherwise required by the Federal Aviation Regulations be installed and operating. When flying RNAV routes, VOR and DME equipment is required.

(4) The FAA recognizes the use of the Naval VLF communications system as a supplement to OMEGA, but not the sole means of navigation.

22. VHF DIRECTION FINDER

a. The VHF Direction Finder (VHF/DF) is one of the common systems that helps pilots without their being aware of its operation. It is a ground based radio receiver used by the operator of the ground station. FAA facilities that provide VHF/DF service are identified in the Airport/Facility Directory.

b. The equipment consists of a directional antenna system and a VHF radio receiver.

c. The VHF/DF receiver display indicates the magnetic direction of the aircraft from the ground station each time the aircraft transmits.

d. DF equipment is of particular value in locating lost aircraft and in helping to identify aircraft on radar. (See PARA. 452 - DIRECTION FINDING INSTRUMENT APPROACH PROCEDURE.)

23. INERTIAL NAVIGATION SYSTEM (INS)

A totally self-contained navigation system, comprised of gyros, accelerometers, and a navigation computer, which provides aircraft position and navigation information in response to signals resulting from inertial effects on system components, and does not require information from external references. INS is aligned with accurate position information prior to departure, and thereafter calculates its position as it progresses to the destination. By programming a series of waypoints, the system will navigate along a predetermined track. New waypoints can be inserted at any time if a revised routing is desired. INS accuracy is very high initially following alignment, and decays with time at the rate of about 1-2 nautical miles per hour. Position update alignment can be accomplished inflight using ground based references, and many INS systems now have sophisticated automatic update using dual DME and or VOR inputs. INS may be approved as the sole means of navigation or may be used in combination with other systems.

24. DOPPLER RADAR

A semiautomatic self-contained dead reckoning navigation system (radar sensor plus computer) which is not continuously dependent on information derived from ground based or external aids. The system employs radar signals to detect and measure ground speed and drift angle, using the aircraft compass system as its directional reference. Doppler is less accurate than INS or OMEGA however, and the use of an external reference is required for periodic updates if acceptable position accuracy is to be achieved on long range flights.

25. FLIGHT MANAGEMENT SYSTEM (FMS)

A computer system that uses a large data base to allow routes to be preprogrammed and fed into the system by means of a data loader. The system is constantly updated with respect to position accuracy by reference to conventional navigation aids. The sophisticated program and its associated data base insures that the most appropriate aids are automatically selected during the information update cycle.

26. GLOBAL POSITIONING SYSTEM (GPS)

A space-base radio positioning, navigation, and time-transfer system being developed by Department of Defense. When fully deployed, the system is intended to provide highly accurate position and velocity information, and precise time, on a continuous global basis, to an unlimited number of properly equipped users. The system will be unaffected by weather, and will provide a worldwide common grid reference system. The GPS concept is predicated upon accurate and continuous knowledge of the spatial position of each satellite in the system with respect to time and distance from a transmitting satellite to the user. The GPS receiver automatically selects appropriate signals from the satellites in view and translates these into a three-dimensional position, velocity, and time. Predicatable system accuracy for civil users is projected to be 100 meters horizontally. Performance standards and certification criteria have not yet been established.

27—29. RESERVED

NOTES

Section 2. RADAR SERVICES AND PROCEDURES

30. RADAR

a. Capabilities

(1) Radar is a method whereby radio waves are transmitted into the air and are then received when they have been reflected by an object in the path of the beam. *Range* is determined by measuring the time it takes (at the speed of light) for the radio wave to go out to the object and then return to the receiving antenna. The *direction* of a detected object from a radar site is determined by the position of the rotating antenna when the reflected portion of the radio wave is received.

(2) More reliable maintenance and improved equipment have reduced radar system failures to a negligible factor. Most facilities actually have some components duplicated-one operating and another which immediately takes over when a malfunction occurs to the primary component.

b. Limitations

(1) It is very important for the aviation community to recognize the fact that there are limitations to radar service and that ATC controllers may not always be able to issue traffic advisories concerning aircraft which are not under ATC control and cannot be seen on radar.

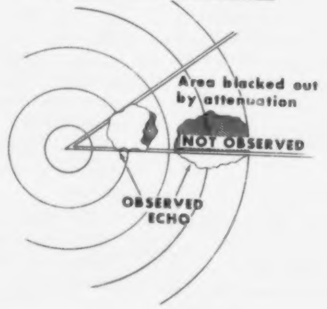
(a) The characteristics of radio waves are such that they normally travel in a continuous straight line unless they are:

1. "Bent" by abnormal atmospheric phenomena such as temperature inversions;

2. Reflected or attenuated by dense objects such as heavy clouds, precipitation, ground obstacles, mountains, etc.; or

3. Screened by high terrain features.

Precipitation Attenuation



The nearby target absorbs and scatters so much of the out- going and returning energy that the radar does not detect the distant target.

(b) The bending of radar pulses, often called anomalous propagation or ducting, may cause many extraneous blips to appear on the radar operator's display if the beam has been bent toward the ground or may decrease the detection range if the wave is bent upward. It is difficult to solve the effects of anomalous propogation, but using beacon radar and electronically eliminating stationary and slow moving targets by a method called moving target indicator (MTI) usually negate the problem.

(c) Radar energy that strikes dense objects will be reflected and displayed on the operator's scope thereby blocking out aircraft at the same range and greatly weakening or completely eliminating the display of targets at a greater range. Again, radar beacon and MTI are very effectively used to combat ground clutter and weather phenomena, and a method of circularly polarizing the radar beam will eliminate some weather returns. A negative characteristic of MTI is that an aircraft flying a speed that coincides with the canceling signal of the MTI (tangential or "blind" speed) may not be displayed to the radar controller.

(d) Relatively low altitude aircraft will not be seen if they are screened by mountains or are below the radar beam due to earth curvature. The only solution to screening is the installation of strategically placed multiple radars which has been done in some areas.

(e) There are several other factors which affect radar control. The amount of reflective surface of an aircraft will determine the size of the radar return. Therefore, a small light airplane or a sleek jet fighter will be more difficult to see on radar than a large commercial jet or

military bomber. Here again, the use of radar beacon is invaluable if the aircraft is equipped with an airborne transponder. All ARTCC radars in the conterminous U.S. and many airport surveillance radars have the capability to interrogate MODE C and display altitude information to the controller from appropriately equipped aircraft. However, there are a number of airport surveillance radars that are still two dimensional (range and azimuth) only and altitude information must be obtained from the pilot.

(f) At some locations within the ATC en route environment, secondary-radar-only (no primary radar) gap filler radar systems are used to give lower altitude radar coverage between two larger radar systems, each of which provides both primary and secondary radar coverage. In those geographical areas served by secondary-radar only, aircraft without transponders cannot be provided with radar service. Additionally, transponder equipped aircraft cannot be provided with radar advisories concerning primary targets and weather. (See RADAR/RADIO DETECTION AND RANGING in the Pilot/Controller Glossary.)

(g) The controllers' ability to advise a pilot flying on instruments or in visual conditions of his proximity to another aircraft will be limited if the unknown aircraft is not observed on radar, if no flight plan information is available, or if the volume of traffic and workload prevent his issuing traffic information. The controller's first priority is given to establishing vertical, lateral, or longitudinal separation between aircraft flying IFR under the control of ATC.

c. FAA radar units operate continuously at the locations shown in the Airport/Facility Directory, and their services are available to all pilots, both civil and military. Contact the associated FAA control tower or ARTCC on any frequency guarded for initial instructions, or in an emergency, any FAA facility for information on the nearest radar service.

31. AIR TRAFFIC CONTROL RADAR BEACON SYSTEM (ATCRBS)

a. The ATCRBS, sometimes referred to as secondary surveillance radar, consists of three main components:

(1) Interrogator. Primary radar relies on a signal being transmitted from the radar antenna site and for this signal to be reflected or "bounced back" from an object (such as an aircraft). This reflected signal is then displayed as a "target" on the controller's radarscope. In the ATCRBS, the *Interrogator*. a ground based radar beacon transmitter-receiver, scans in synchronism with the primary radar and transmits discrete radio signals which repetitiously requests all transponders, on the mode being used, to reply. The replies received are then mixed with the primary returns and both are displayed on the same radarscope.

(2) Transponder. This airborne radar beacon transmitter-receiver automatically receives the signals from the interrogator and selectively replies with a specific pulse group (code) only to those interrogations being received on the mode to which it is set. These replies are independent of, and much stronger than a primary radar return.

(3) Radarscope. The radarscope used by the controller displays returns from both the primary radar system and the ATCRBS. These returns, called targets, are what the controller refers to in the control and separation of traffic.

b. The job of identifying and maintaining identification of primary radar targets is a long and tedious task for the controller. Some of the advantages of ATCRBS over primary radar are:

(1) Reinforcement of radar targets.

(2) Rapid target identification.

(3) Unique display of selected codes.

c. A part of the ATCRBS ground equipment is the decoder. This equipment enables the controller to assign discrete transponder codes to each aircraft under his control. Normally only one code will be assigned for the entire flight. Assignments are made by the ARTCC computer on the basis of the National Beacon Code Allocation Plan. The equipment is also designed to receive MODE C altitude information from the aircraft.

NOTE.— Refer to figures with explanatory legends for an illustration of the target symbology depicted on radar scopes in the NAS Stage A (en route), the ARTS III (terminal) systems, and other nonautomated (broadband) radar systems.

d. It should be emphasized that aircraft transponders greatly improve the effectiveness of radar systems. (See PARA—170 - TRANSPONDER OPERATION.)

32. SURVEILLANCE RADAR

a. Surveillance radars are divided into two general categories: Airport Surveillance Radar (ASR) and Air Route Surveillance Radar (ARSR).

(1) ASR is designed to provide relatively short-range coverage in the general vicinity of an airport and to serve as an expeditious means of handling terminal area traffic through observation of precise aircraft locations on a radarscope. The ASR can also be used as an instrument approach aid.

(2) ARSR is a long-range radar system designed primarily to provide a display of aircraft locations over large areas.

b. Surveillance radars scan through 360 degrees of azimuth and present target information on a radar display located in a tower or center. This information is used independently or in conjunction with other navigational aids in the control of air traffic.

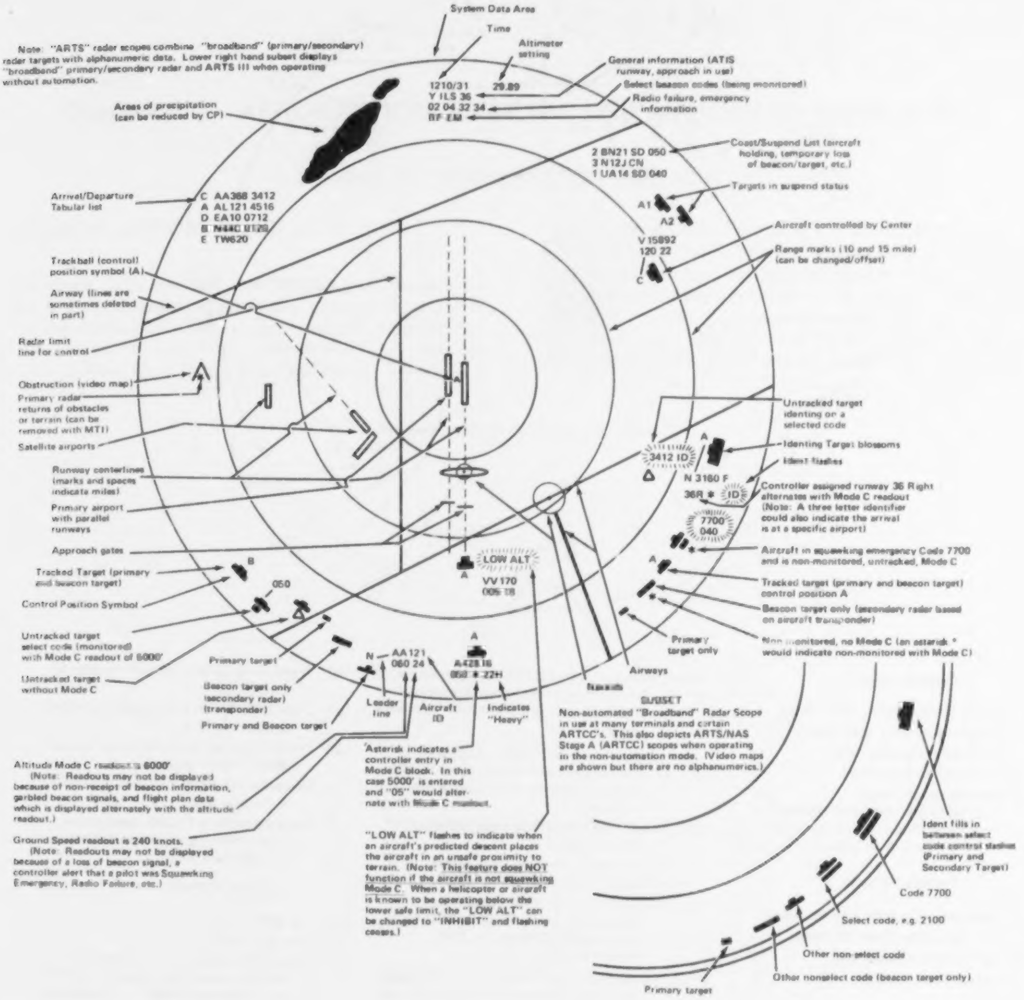
33. PRECISION APPROACH RADAR (PAR)

a. PAR is designed to be used as a *landing aid*, rather than an aid for sequencing and spacing aircraft. PAR equipment may be used as a primary landing aid, or it may be used to monitor other types of approaches. It is designed to display *range*, *azimuth* and *elevation* information.

b. Two antennas are used in the PAR array, one scanning a vertical plane, and the other scanning horizontally. Since the range is limited to 10 miles, azimuth to 20 degrees, and elevation to 7 degrees, only the final approach area is covered. Each scope is divided into two parts. The upper half presents altitude and distance information, and the lower half presents azimuth and distance.

34—39. RESERVED

Note: "ARTS" radar scopes combine "broadband" (primary/secondary) radar targets with alphanumeric data. Lower right hand subset displays "broadband" primary/secondary radar and ARTS III when operating without automation.


System Data Area
Time
Altimeter setting
1210/31
29.89
Y ILS 36
02 04 32 34
RF EM
General information (ATIS runway, approach in use)
Select beacon codes (being monitored)
Radio failure, emergency information
Areas of precipitation (can be reduced by CP)
Coast/Suspend List (aircraft holding, temporary loss of beacon/target, etc.)
2 BN21 SD 050
3 N12J CN
1 UA14 SD 040
Targets in suspend status
A1
A2
Arrival/Departure Tabular list
C AA368 3412
A AL121 4516
D EA10 0712
B N44C 0120
E TW620
Aircraft controlled by Center
V 15892
120 22
C
Range marks (10 and 15 mile) (can be changed/offset)
Trackball (control) position symbol (A)
Airway (lines are sometimes deleted in part)
Radar limit line for control
Obstruction (video map)
Primary radar returns of obstacles or terrain (can be removed with MTI)
Satellite airports
Runway centerlines (marks and spaces indicate miles)
Primary airport with parallel runways
Approach gates
Untracked target identing on a selected code
Identing Target blossoms
Ident flashes
A
3412 ID
N 3180 F
36R ✱ ID
Controller assigned runway 36 Right alternates with Mode C readout (Note: A three letter identifier could also indicate the arrival is at a specific airport)
7700
040
Aircraft in squawking emergency Code 7700 and is non-monitored, untracked, Mode C
Tracked target (primary and beacon target) control position A
Beacon target only (secondary radar based on aircraft transponder)
Non monitored, no Mode C (an asterisk * would indicate non-monitored with Mode C)
Primary target only
Airways
Navaids
LOW ALT
A
VV 170
005 18
B
Tracked Target (primary and beacon target)
050
Control Position Symbol
Untracked target select code (monitored) with Mode C readout of 5000'
Untracked target without Mode C
Primary target
Beacon target only (secondary radar) (transponder)
Primary and Beacon target
N
AA 121
060 24
Leader line
Aircraft ID
A
A428 16
050 ✱ 22H
Indicates "Heavy"
Ident fills in between select code control slashes (Primary and Secondary Target)
Code 7700
Select code, e.g. 2100
Other non-select code
Other nonselect code (beacon target only)
Primary target

Altitude Mode C readout is 6000'
(Note: Readouts may not be displayed because of non-receipt of beacon information, garbled beacon signals, and flight plan data which is displayed alternately with the altitude readout.)

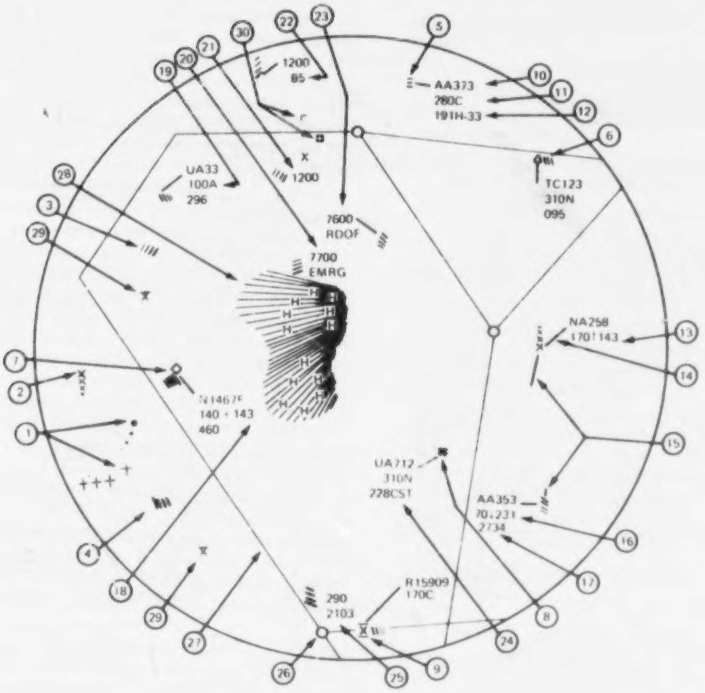
Ground Speed readout is 240 knots.
(Note: Readouts may not be displayed because of a loss of beacon signal, a controller alert that a pilot was Squawking Emergency, Radio Failure, etc.)

Asterisk indicates a controller entry in Mode C block. In this case 5000' is entered and "05" would alternate with Mode C readout.

"LOW ALT" flashes to indicate when an aircraft's predicted descent places the aircraft in an unsafe proximity to terrain. (Note: This feature does NOT function if the aircraft is not squawking Mode C. When a helicopter or aircraft is known to be operating below the lower safe limit, the "LOW ALT" can be changed to "INHIBIT" and flashing ceases.)

SUBSET
Non-automated "Broadband" Radar Scope in use at many terminals and certain ARTCC's. This also depicts ARTS/NAS Stage A (ARTCC) scopes when operating in the non-automation mode. (Video maps are shown but there are no alphanumerics.)

ARTS III Radar Scope with Alphanumeric Data. Note: A number of radar terminals do not have ARTS equipment. Those facilities and certain ARTCC's outside the contiguous US would have radar displays similar to the lower right hand subset. ARTS facilities and NAS Stage A ARTCC's, when operating in the non-automation mode would also have similar displays and certain services based on automation may not be available.



Target Symbols

1 Uncorrelated primary radar target + ●
2 *Correlated primary radar target X
3 Uncorrelated beacon target /
4 Correlated beacon target \
5 Identing beacon target ≡
(*Correlated means the association of radar data with the computer projected track of an identified aircraft)

Position Symbols

6 Free track (No flight plan tracking) △
7 Flat track (flight plan tracking) ◇
8 Coast (Beacon target lost) #
9 Present Position Hold ⧗

Data Block Information

10 *Aircraft Identification
11 *Assigned Altitude FL280, mode C altitude same or within ±200' of asgnd altitude
12 *Computer ID #191, Handoff is to Sector 33 (0-33 would mean handoff accepted) (*Nr's 10, 11, 12 constitute a "full data block")
13 Assigned altitude 17,000', aircraft is climbing, mode C readout was 14,300 when last beacon interrogation was received
14 Leader line connecting target symbol and data block
15 Track velocity and direction vector line (Projected ahead of target)
16 Assigned altitude 7000, aircraft is descending, last mode C readout (or last reported altitude was 100' above FL230
17 Transponder code shows in full data block only when different than assigned code
18 Aircraft is 300' above assigned altitude
19 Reported altitude (No mode C readout) same as assigned. An "N" would indicate no reported altitude)
20 Transponder set on emergency code 7700 (EMRG flashes to attract attention)
21 Transponder code 1200 (VFR) with no mode C
22 Code 1200 (VFR) with mode C and last altitude readout
23 Transponder set on Radio Failure code 7600, (RDOF flashes)
24 Computer ID #228, CST indicates target is in Coast status
25 Assigned altitude FL290, transponder code (These two items constitute a "limited data block")

Other symbols

26 Navigational Aid
27 Airway or jet route
28 Outline of weather returns based on primary radar (See Chapter 4, ARTCC Radar Weather Display. H's represent areas of high density precipitation which might be thunderstorms. Radial lines indicate lower density precipitation)
29 Obstruction
30 Airports Major: □ , Small: ⌜

NAS Stage A Controllers View Plan Display. This figure illustrates the controller's radar scope (PVD) when operating in the full automation (RDP) mode, which is normally 20 hours per day. (Note: When not in automation mode, the display is similar to the broadband mode shown in the ARTS III Radar Scope figure. Certain ARTCC's outside the contiguous U.S. also operate in "broadband" mode.)

Chapter 2. AERONAUTICAL LIGHTING AND AIRPORT MARKING AIDS

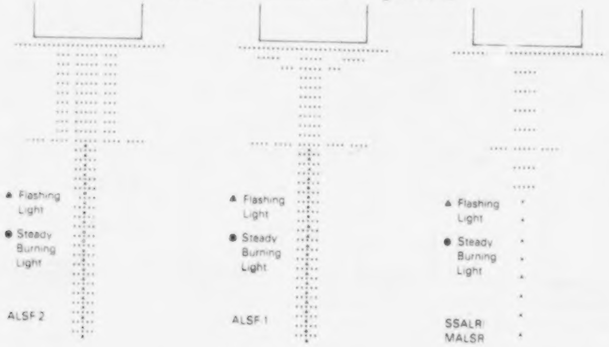
Section 1. AIRPORT LIGHTING AIDS

40. APPROACH LIGHT SYSTEMS (ALS)

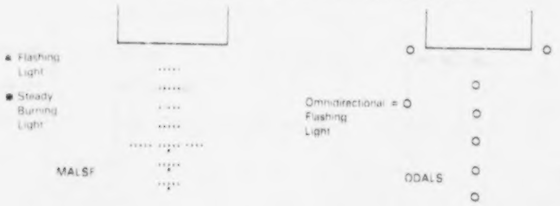
a. Approach light systems provide the basic means for transition from instrument flight using electronic approach aids to visual flight and landing. Operational requirements dictate the sophistication and configuration of the approach light system for a particular runway.

b. Approach light systems are a configuration of signal lights starting at the landing threshold and extending into the approach area a distance of 2400-3000 feet for precision instrument runways and 1400-1500 feet for nonprecision instrument runways. Some systems include sequenced flashing lights which appear to the pilot as a ball of light traveling towards the runway at high speed twice a second.

Precision Instrument Configurations



Nonprecision Instrument Configurations



41. VISUAL APPROACH SLOPE INDICATOR (VASI)

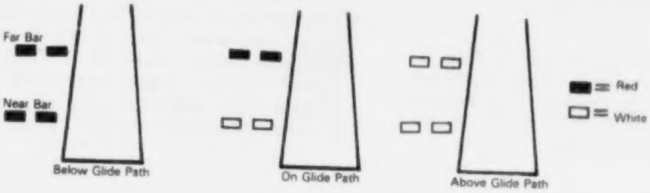
a. The VASI is a system of lights so arranged to provide visual descent guidance information during the approach to a runway. These lights are visible from 3-5 miles during the day and up to 20 miles or more at night. The visual glide path of the VASI provides safe obstruction clearance within plus or minus 10 degrees of the extended runway centerline and to 4 NM from the runway threshold. Descent, using the VASI, should not be initiated until the aircraft is visually aligned with the runway. Lateral course guidance is provided by the runway or runway lights.

b. VASI installations may consist of either 2, 4, 6, 12, or 16 lights units arranged in bars referred to as near, middle, and far bars. Most VASI installations consist of 2 bars, near and far, and may consist of 2, 4, or 12 light units. Some airports have VASIs consisting of three bars, near, middle, and far, which provide an additional visual glide path for use by high cockpit aircraft. This installation may consist of either 6 or 16 light units. VASI installations consisting of 2, 4, or 6 light units are located on one side of the runway, usually the left. Where the installation consists of 12 or 16 light units, the light units are located on both sides of the runway.

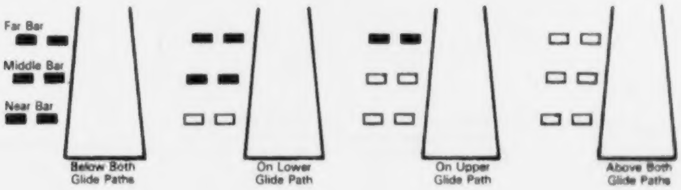
c. Two-bar VASI installations provide one visual glide path which is normally set at 3 degrees. Three-bar VASI installations provide two visual glide paths. The lower glide path is provided by the near and middle bars and is normally set at 3 degrees while the upper glide path, provided by the middle and far bars, is normally 1/4 degree higher. This higher glide path is intended for use only by high cockpit aircraft to provide a sufficient threshold crossing height. Although normal glide path angles are three degrees, angles at some locations may be as high as 4.5 degrees to give proper obstacle clearance. Pilots of high performance aircraft are cautioned that use of VASI angles in excess of 3.5 degrees may cause an increase in runway length required for landing and rollout.

d. The basic principle of the VASI is that of color differentiation between red and white. Each light unit projects a beam of light having a white segment in the upper part of the beam and red segment in the lower part of the beam. The light units are arranged so that the pilot using the VASIs during an approach will see the combination of lights shown below.

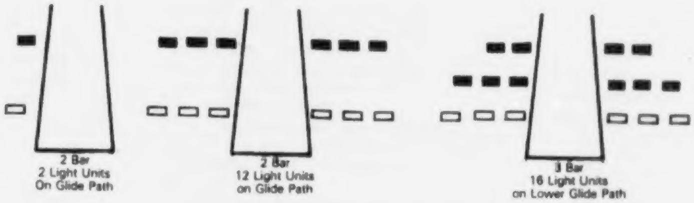
e. 2-bar VASI (4 light units shown)


Far Bar
Near Bar
Below Glide Path
On Glide Path
Above Glide Path
▬ = Red
▭ = White

f. 3-bar VASI (6 light units shown)


Far Bar
Middle Bar
Near Bar
Below Both Glide Paths
On Lower Glide Path
On Upper Glide Path
Above Both Glide Paths

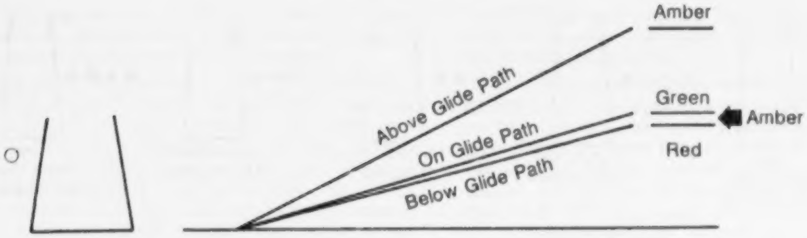
g. Other VASI configurations


2 Bar
2 Light Units
On Glide Path
2 Bar
12 Light Units
on Glide Path
3 Bar
16 Light Units
on Lower Glide Path

42. OTHER VISUAL APPROACH SLOPE SYSTEMS

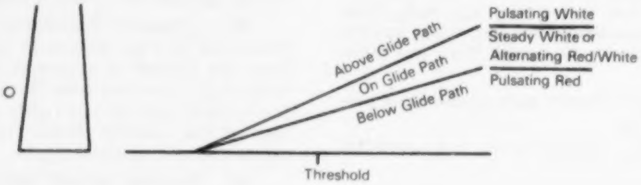
a. Several types of nonstandard visual approach slope indicators have been installed at general aviation and air carrier airports.

b. Tri-color visual approach slope indicators normally consist of a single light unit projecting a three-color visual approach path into the final approach area of the runway upon which the indicator is installed. The below glide path indication is red, the above glide path indication is amber, and the on glide path indication is green. These types of indicators have a useful range of approximately one-half to one mile during the day and up to five miles at night depending upon the visibility conditions.


Amber
Above Glide Path
Green
Amber
On Glide Path
Red
Below Glide Path

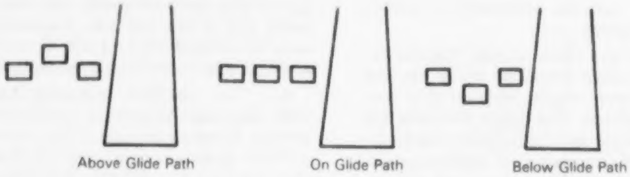
Caution: When the aircraft descends from green to red, the pilot may see a dark amber color during the transition from green to red.

c. Pulsating visual approach slope indicators normally consist of a single light unit projecting a two-color visual approach path into the final approach area of the runway upon which the indicator is installed. The below glide path indication is normally pulsating red and the above glide path indication is normally pulsating white. The on glide path indication for one type of system is a steady white light while for another type system the on glide path indication consists of an alternating red and white light. The useful range of these systems is about four miles during the day and up to ten miles at night.

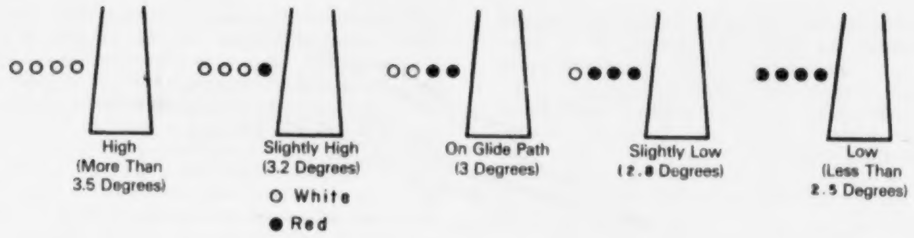

Pulsating White
Above Glide Path
Steady White or
Alternating Red/White
On Glide Path
Pulsating Red
Below Glide Path
Threshold

Caution: When viewing the pulsating visual approach slope indicators in the pulsating white or pulsating red sectors, it is possible to mistake this lighting aid for another aircraft or a ground vehicle. Pilots should exercise caution when using this type of system.

d. Alignment of elements systems are installed on some small general aviation airports and are a low-cost system consisting of painted plywood panels, normally black and white or fluorescent orange. Some of these systems are lighted for night use. The useful range of these systems is approximately three-quarter miles. To use the system the pilot positions his aircraft so the elements are in alignment. The glide path indications are as follows.


Above Glide Path
On Glide Path
Below Glide Path

e. The precision approach path indicator (PAPI) uses light units similar to the VASI but are installed in a single row of either two or four light units. These systems have an effective visual range of about 5 miles during the day and up to 20 miles at night. The row of light units is normally installed on the left side of the runway and the glide path indications are as follows.


○○○○
○○○●
○○●●
○●●●
●●●●
High (More Than 3.5 Degrees)
Slightly High (3.2 Degrees)
On Glide Path (3 Degrees)
Slightly Low (2.8 Degrees)
Low (Less Than 2.5 Degrees)
○ White
● Red

43. RUNWAY END IDENTIFIER LIGHTS (REIL)

REILs are installed at many airfields to provide rapid and positive identification of the approach end of a particular runway. The system consists of a pair of synchronized flashing lights, one of which is located laterally on each side of the runway threshold. REILs may be either omnidirectional or unidirectional facing the approach area. REILs may be located longitudinally 200 feet either upwind or downwind from the runway threshold. They are effective for:

(1) Identification of a runway surrounded by a preponderance of other lighting.

(2) Identification of a runway which lacks contrast with surrounding terrain.

(3) Identification of a runway during reduced visibility.

44. RUNWAY EDGE LIGHT SYSTEMS

a. Runway edge lights are used to outline the edges of runways during periods of darkness and restricted visibility conditions. These light systems are classified according to the intensity or brightness they are capable of producing: they are the High Intensity Runway Lights (HIRL), Medium Intensity Runway Lights (MIRL), and the Low Intensity Runway Lights (LIRL). The HIRL and MIRL systems have variable intensity controls, whereas the LIRLs normally have one intensity setting.

b. The runway edge lights are white except that on instrument runways aviation yellow replaces white on the last 2,000 feet or half the runway length, whichever is less, to form a caution zone for landings. The lights marking the longitudinal limits of the runway emit red light toward the runway to indicate the end of runway to a departing aircraft and emit green outward from the runway end to indicate the threshold to landing aircraft.

45. IN-RUNWAY LIGHTING

a. Touchdown zone lighting and runway centerline lighting are installed on some precision approach runways to facilitate landing under adverse visibility conditions. Taxiway turnoff lights may be added to expedite movement of aircraft from the runway.

(1) **Touchdown Zone Lighting (TDZL)** — two rows of transverse light bars disposed symmetrically about the runway centerline in the runway touchdown zone. The system starts 100 feet from the landing threshold and extends to 3000 feet from the threshold or the midpoint of the runway, whichever is the lesser.

(2) **Runway Centerline Lighting (RCLS)** — flush centerline lights spaced at 50-foot intervals beginning 75 feet from the landing threshold and extending to within 75 feet of opposite end of the runway.

(3) **Runway Remaining Lighting** — is applied to centerline lighting systems in the final 3,000 feet as viewed from the takeoff or approach position. Alternate red and white lights are seen from the 3,000 foot points to the 1,000 foot points, and all red lights are seen for the last 1,000 feet of the runway. From the opposite direction, these lights are seen as white lights.

(4) **Taxiway turnoff lights** — flush lights spaced at 50 foot intervals defining the curved path of aircraft travel from the runway centerline to a point on the taxiway.

46. CONTROL OF LIGHTING SYSTEMS

a. Operation of approach light systems and runway lighting is controlled by the control tower. At some locations the FSS may control the lights where there is no control tower in operation.

b. Pilots may request that lights be turned on or off. Runway edge lights, in-pavement lights and approach lights also have intensity controls which may be varied to meet the pilots request. Sequenced flashing lights (SFL) may be turned on and off. Some sequenced flashing light systems also have intensity control.

c. The Medium Intensity Approach Lighting System with Runway Alignment Indicators (MALSR) has been installed at many airports. The control of MALSR is now by ATCTs and/or radio control from approaching aircraft. (See PARA—47 - PILOT CONTROL OF AIRPORT LIGHTING.)

47. PILOT CONTROL OF AIRPORT LIGHTING

a. Radio control of lighting is available at selected airports to provide airborne or ground control of lights by keying the aircraft's microphone. Control of lighting systems is available either full-time at those locations without specified hours for lighting or with no control tower or FSS, or part-time (during unmanned periods) at those locations with a part-time tower or FSS or specified hours for

lighting. All lighting systems which are to be radio controlled at an airport, whether on a single runway or multiple runways, operate on the same radio frequency.

b. With FAA approved systems, various combinations of medium intensity approach lights, runway lights, taxiway lights, VASI and/or REIL may be activated by radio control. On runways with both approach lighting and runway lighting (runway edge lights, taxiway lights, etc.) systems, the approach lighting system takes precedence for air-to-ground radio control over the runway lighting system which is set at a predetermined intensity step, based on expected visibility conditions. Runways without approach lighting may provide radio controlled intensity adjustments of runway edge lights. Other lighting systems, including VASI, REIL, and taxiway lights may be either controlled with the runway edge lights or controlled independently of the runway edge lights.

c. The control system consists of a 3-step control responsive to 7, 5, and/or 3 microphone clicks. This 3-step control will turn on lighting facilities capable of either 3-step, 2-step or 1-step operation. The 3-step and 2-step lighting facilities can be altered in intensity, while the 1-step cannot. All lighting is illuminated for a period of 15 minutes from the most recent time of activation and may not be extinguished prior to end of the 15 minute period (except for 1-step and 2-step REILs which may be turned off when desired by keying the mike 5 or 3 times respectively).

AIRPORT LIGHTING AIDS

TABLE 1. RUNWAYS WITH APPROACH LIGHTS

Lighting System	No. of Int. Steps	Status During Nonuse Period	Intensity Step Selected Per No. of Mike Clicks		
			3 Clicks	5 Clicks	7 Clicks
Approach Lights (Med. Int.)	2	Off	Low	Low	High
Approach Lights (Med. Int.)	3	Off	Low	Med	High
MIRL	3	Off or Low	⌘	⌘	⌘
HIRL	5	Off or Low	⌘	⌘	⌘
VASI	2	Off	◊	◊	◊

NOTES:

⌘ Predetermined intensity step.
◊ Low intensity for night use. High intensity for day use as determined by photocell control.

TABLE 2. RUNWAYS WITHOUT APPROACH LIGHTS

Lighting System	No. of Int. Steps	Status During Nonuse Period	Intensity Step Selected Per No. of Mike Clicks		
			3 Clicks	5 Clicks	7 Clicks
MIRL	3	Off or Low	Low	Med.	High
HIRL	5	Off or Low	Step 1 or 2	Step 3	Step 5
LIRL	1	Off	On	On	On
VASI ☆	2	Off	◊	◊	◊
REIL ☆	1	Off	Off	On / Off	On
REIL ☆	3	Off	Low	Med.	High

NOTES:

◊ Low intensity for night use. High intensity for day use as determined by photocell control.
☆ The control of VASI and/or REIL may be independent of other lighting systems.

d. Suggested use is to always initially key the mike 7 times; this assures that all controlled lights are turned on to the maximum available intensity. If desired, adjustment can then be made, where the capability is provided, to a lower intensity (or the REIL turned off) by keying 5 and/or 3 times. Even though the runway lights are on when arriving over an airport of intended landing, always key mike as directed in order to assure a full 15 minutes lighting duration. Approved lighting systems may be activated by keying the mike (within 5 seconds) as indicated below:

RADIO CONTROL SYSTEM

Key Mike	*Function*
7 times within 5 seconds	Highest intensity available
5 times within 5 seconds	Medium or lower intensity (Lower REIL or REIL-off)
3 times within 5 seconds	Lowest intensity available (Lower REIL or REIL-off)

e. For all public use airports with FAA standard systems the Airport/Facility Directory contains the types of lighting, runway and the frequency that is used to activate the system. Airports with IAPs include data on the approach chart identifying the light system, the runway on which they are installed, and the frequency that is used to activate the system.

EXAMPLE:

ACTIVATE MIRL Rwy 18/36-122.8.

EXAMPLE:

ACTIVATE MALSR, VASI and REIL Rwy 7, HIRL Rwy 7-25, and REIL Rwy 25-122.8.

f. Where the airport is not served by an IAP, it may have either the standard FAA approved control system or an independent type system of different specification installed by the airport sponsor. The Airport/Facility Directory contains descriptions of pilot controlled lighting systems for each airport having other than FAA approved systems, and explains the type lights, method of control, and operating frequency in clear text.

48. AIRPORT (ROTATING) BEACONS

a. The airport beacon has a vertical light distribution such as to make it most effective at angles of one up to 10 degrees above the horizontal from its site; however, it can be seen well above and below this peak spread. The beacon may be an omnidirectional capacitor-discharge device, or it

may rotate at a constant speed which produces the visual effect of flashes at regular intervals. Flashes may be one or two colors alternately. The total number of flashes are:

(1) 12 to 30 per minute for beacons marking airports, landmarks, and points on Federal airways.

(2) 30 to 60 per minute for beacons marking heliports.

b. The colors and color combinations of beacons are:

(1) White and Green — Lighted land airport

(2) *Green alone — Lighted land airport

(3) White and Yellow — Lighted water airport

(4) *Yellow alone — Lighted water airport

(5) White and Red — Landmark or navigational point (rare installation)

(6) White alone — Unlighted land airport (rare installation)

(7) Green, Yellow, and White — Lighted heliport

NOTE.— *Green alone or yellow alone is used only in connection with a white-and-green or white-and-yellow beacon display, respectively.

c. Military airport beacons flash alternately white and green, but are differentiated from civil beacons by dual-peaked (two quick) white flashes between the green flashes.

d. In control zones, operation of the airport beacon during the hours of daylight often indicates that the ground visibility is less than 3 miles and/or the ceiling is less than 1,000 feet. ATC clearance in accordance with FAR—91 would be required for landing, takeoff and flight in the traffic pattern. Pilots should not rely solely on the operation of the airport beacon to indicate weather conditions, IFR versus VFR. At locations with control towers and if controls are provided, ATC personnel turn the beacon on. However, at many airports throughout the country, the airport beacon is turned on by a photoelectric cell or time clocks and ATC personnel have no control as to when it shall be turned on. Also, there is no regulatory requirement for daylight operation and pilots are reminded that it remains their responsibility for complying with proper preflight planning in accordance with FAR—91.5.

49. RUNWAY DISTANCE REMAINING MARKERS

Runway distance remaining markers consist of signs located along the sides of a runway to indicate the remaining runway distance in increments of 1,000 feet. The signs may be located on both sides, or only one side, of the runway. The signs have white numerals on a black background and are lighted for nighttime and low visibility operations. Since runways rarely exist in exact multiples of 1,000 feet, the excess distance is added to the runway ends. Therefore, the last sign on each runway end may be located more, but never less, then 1,000 feet from the runway end. For this reason, the runway distance remaining markers often will not exactly coincide with distance remaining information of other runway lighting systems.

NOTES

Section 2. AIR NAVIGATION AND OBSTRUCTION LIGHTING

50. AERONAUTICAL LIGHT BEACONS

a. An aeronautical light beacon is a visual NAVAID displaying flashes of white and/or colored light to indicate the location of an airport, a heliport, a landmark, a certain point of a Federal airway in mountainous terrain, or an obstruction. The light used may be a rotating beacon or one or more flashing lights. The flashing lights may be supplemented by steady burning lights of lesser intensity.

b. The color or color combination displayed by a particular beacon and/or its auxiliary lights tell whether the beacon is indicating a landing place, landmark, point of the Federal airways, or an obstruction. Coded flashes of the auxiliary lights, if employed, further identify the beacon site.

51. CODE BEACONS AND COURSE LIGHTS

a. CODE BEACONS

(1) The code beacon, which can be seen from all directions, is used to identify airports and landmarks and to mark obstructions. The number of code beacon flashes are:

(a) **Green coded flashes** not exceeding 40 flashes or character elements per minute, or constant flashes 12 to 15 per minute, for identifying land airports.

(b) **Yellow coded flashes** not exceeding 40 flashes or character elements per minute, or constant flashes 12 to 15 per minute, for identifying water airports.

(c) **Red flashes,** constant rate, 12 to 40 flashes per minute for marking hazards.

b. COURSE LIGHTS

(1) The course light, which can be seen clearly from only one direction, is used only with rotating beacons of the Federal Airway System: two course lights, back to back, direct coded flashing beams of light in either direction along the course of airway.

NOTE.— Airway beacons are remnants of the "lighted" airways which antedated the present electronically equipped Federal Airways System. Only a few of these beacons exist today to mark airway segments in remote mountain areas. Flashes in Morse Code identify the beacon site.

52. OBSTRUCTION LIGHTS

a. Obstructions are marked/lighted to warn airmen of its presence during daytime and nighttime conditions. They may be marked/lighted in any of the following combinations:

(1) **Aviation Red Obstruction Lights.** Flashing aviation red beacons and steady burning aviation red lights during nighttime operation. Aviation orange and white paint is used for daytime marking.

(2) **High Intensity White Obstruction Lights.** Flashing high intensity white lights during daytime with reduced intensity for twilight and nighttime operation. When this type system is used, the marking of structures with red obstruction lights and aviation orange and white paint may be omitted.

(3) **Dual Lighting.** A combination of flashing aviation red beacons and steady burning aviation red lights for nighttime operation and flashing high intensity white lights for daytime operation. Aviation orange and white paint may be omitted.

b. High intensity flashing white lights are being used to identify some supporting structures of overhead transmission lines located across rivers, chasms, gorges, etc. These lights flash in a middle, top, lower light sequence at approximately 60 flashes per minute. The top light is normally installed near the top of the supporting structure, while the lower light indicates the approximate lower portion of the wire span. The lights are beamed towards the companion structure and identify the area of the wire span.

c. High intensity, flashing white lights are also employed to identify tall structures, such as chimneys and towers, as obstructions to air navigation. The lights provide a 360 degree coverage about the structure at 40 flashes per minute and consist of from one to seven levels of lights depending upon the height of the structure. Where more than one level is used the vertical banks flash simultaneously.

53—59. RESERVED

NOTES

Section 3. AIRPORT MARKING AIDS

60. AIRPORT MARKING AIDS

a. In the interest of safety, regularity, or efficiency of aircraft operations, the FAA has recommended, for the guidance of the public, the following airport marking.

NOTE.— Refer to ADVISORY CIRCULAR—150/5340-1 Marking of Paved Areas on Airports for detailed airport marking information.

b. Runway designators — Runway numbers and letters are determined from the approach direction. The runway number is the whole number nearest one-tenth the magnetic azimuth of the centerline of the runway, measured clockwise from the magnetic north. The letter, or letters, differentiate between left (L), right (R), or center (C) parallel runways, as applicable:

(1) For two parallel runways "L" "R"

(2) For three parallel runways "L" "C" "R"

c. Visual Runway Marking — Used for operations under Visual Flight Rules:

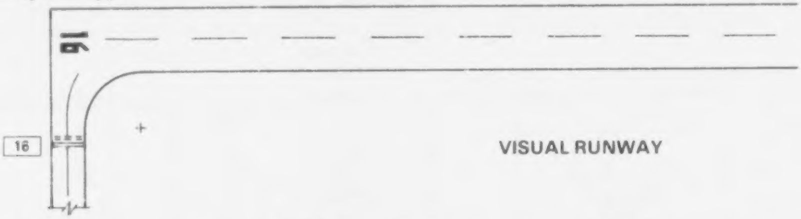
(1) Centerline marking.

(2) Designation marking.

(3) Threshold marking (on runways used or intended to be used by international commercial air transport.)

(4) Fixed distance marking (on runways 4,000 feet (1200 m) or longer used by jet aircraft.)

(5) Holding position markings (for taxiway/runway intersections.)



VISUAL RUNWAY

d. NonPrecision Instrument Runway Marking — Used on runways served by a nonvisual navigation aid and intended for landings under instrument weather conditions:

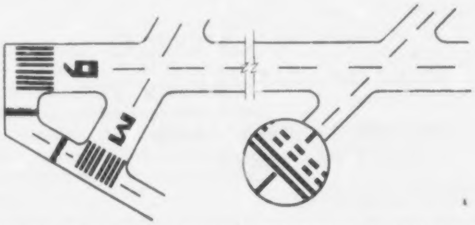
(1) Centerline marking.

(2) Designation marking.

(3) Threshold marking.

(4) Fixed distance marking (on runways 4,000 feet (1200 m) or longer used by jet aircraft.

(5) Holding position markings (for taxiway/runway intersections and instrument landing system (ILS) critical areas.)



NON-PRECISION INSTRUMENT RUNWAY

e. Precision Instrument Runway Marking — Used on runways served by nonvisual precision approach aids and on runways having special operational requirements:

(1) Centerline marking.

(2) Designation marking.

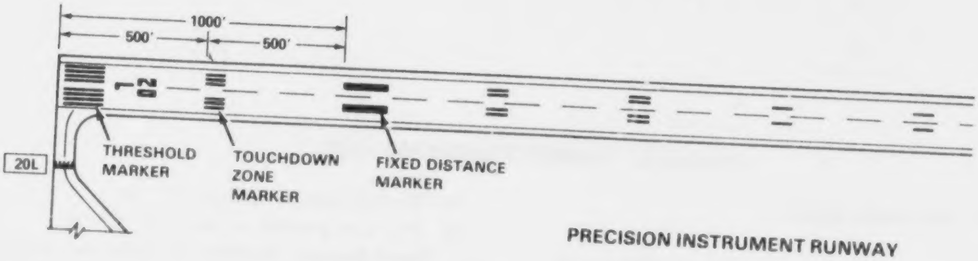
(3) Threshold marking.

(4) Fixed distance marking.

(5) Touchdown zone marking.

(6) Side stripes.

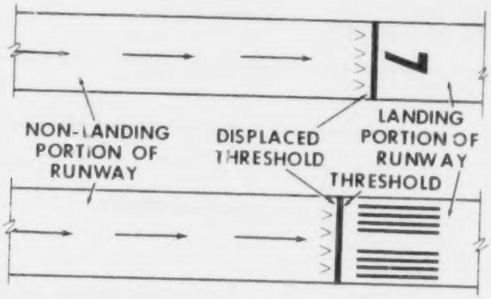
(7) Holding position markings (for taxiway/runway intersections and ILS critical areas.)


1000'
500'
500'
20L
THRESHOLD MARKER
TOUCHDOWN ZONE MARKER
FIXED DISTANCE MARKER

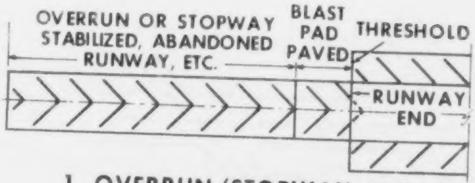
PRECISION INSTRUMENT RUNWAY

f. **Threshold** — The designated beginning of the runway that is available and suitable for the landing of aircraft.

g. **Displaced Threshold** — A threshold that is not at the beginning of the full strength runway pavement. The paved area behind the displaced runway threshold is available for taxiing, the landing rollout, and the takeoff of aircraft.

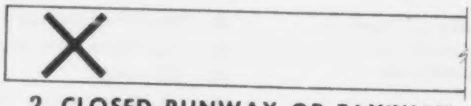

7
NON-LANDING PORTION OF RUNWAY
DISPLACED THRESHOLD
LANDING PORTION OF RUNWAY
THRESHOLD

h. **Overrun and Stopway Areas** — Any surface or area extending beyond the usable runway which appears usable but which, due to the nature of its structure, is unusable.


OVERRUN OR STOPWAY STABILIZED, ABANDONED RUNWAY, ETC.
BLAST PAD PAVED
THRESHOLD
RUNWAY END

1. OVERRUN/STOPWAY AND BLAST PAD AREA

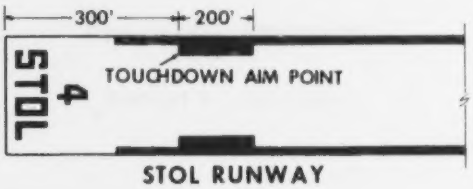
i. **Closed Runway** — A runway which is unusable and may be hazardous even though it may appear usable.



2. CLOSED RUNWAY OR TAXIWAY

j. **Fixed Distance Marker** — To provide a fixed distance marker for landing of turbojet aircraft on other than a precision instrument runway. This marking is similar to the fixed distance marking on a precision instrument runway and located 1,000 feet from the threshold.

k. **STOL (Short Take Off and Landing) Runway** — In addition to the normal runway number marking, the letters STOL are painted on the approach end of the runway and a touchdown aim point is shown.



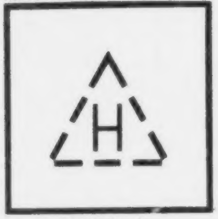
STOL RUNWAY

l. **Taxiway Marking** — The taxiway centerline is marked with a continuous yellow line. The taxiway edge may be marked with two continuous yellow lines 6 inches apart. Taxiway HOLDING LINES consist of two continuous and two dashed lines, spaced 6 inches between lines, perpendicular to the taxiway centerline; more recently, HOLD LINES also consist of one or more signs at the edge of the taxiway, with white characters on a red sign face.

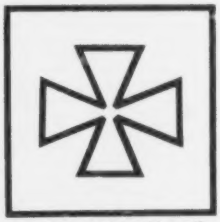
NOTE.— When instructed by ATC "HOLD SHORT OF (runway, ILS critical area, etc.)," the pilot should stop so no part of the aircraft extends beyond the holding line. When approaching the holding line from the side with the continuous lines, a pilot should not cross the holding line without ATC clearance at a controlled airport or without making sure of adequate separation from other aircraft at uncontrolled airports. An aircraft exiting the runway is not clear until all parts of the aircraft have crossed the holding line.

m. **Helicopter Landing Areas** — Details on heliport markings can be found in ADVISORY CIRCULAR—150/5390-1, Heliport Design Guide.

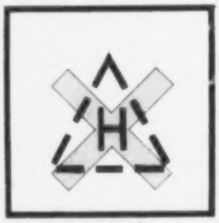
HELICOPTER LANDING AREA



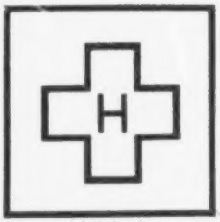
Recommended Marking for Civil Heliports



Some Civil and Military Heliports May Be Marked With This Symbol



Recommended Marking for Closed Heliports



Recommended Marking for Hospital Heliports

61. AIRCRAFT ARRESTING DEVICES

a. Certain airports are equipped with a means of rapidly stopping military aircraft on a runway. This equipment, normally referred to as EMERGENCY ARRESTING GEAR, generally consists of pendant cables supported over the runway surface by rubber "donuts". Although most devices are located in the overrun areas, a few of these arresting systems have cables stretched over the operational areas near the ends of a runway.

b. Arresting cables which cross over a runway require special markings on the runway to identify the cable location. These markings consist of 10 feet diameter solid circles painted "identification yellow", 30 feet on center, perpendicular to the runway centerline across the entire runway width. Additional details are contained in ADVISORY CIRCULAR—150/5220-9, Aircraft Arresting Systems for Joint/Civil Military Airports.

NOTE.— Aircraft operations on the runway are NOT restricted by the installation of aircraft arresting devices.

62—69. RESERVED

NOTES

Chapter 3. AIRSPACE

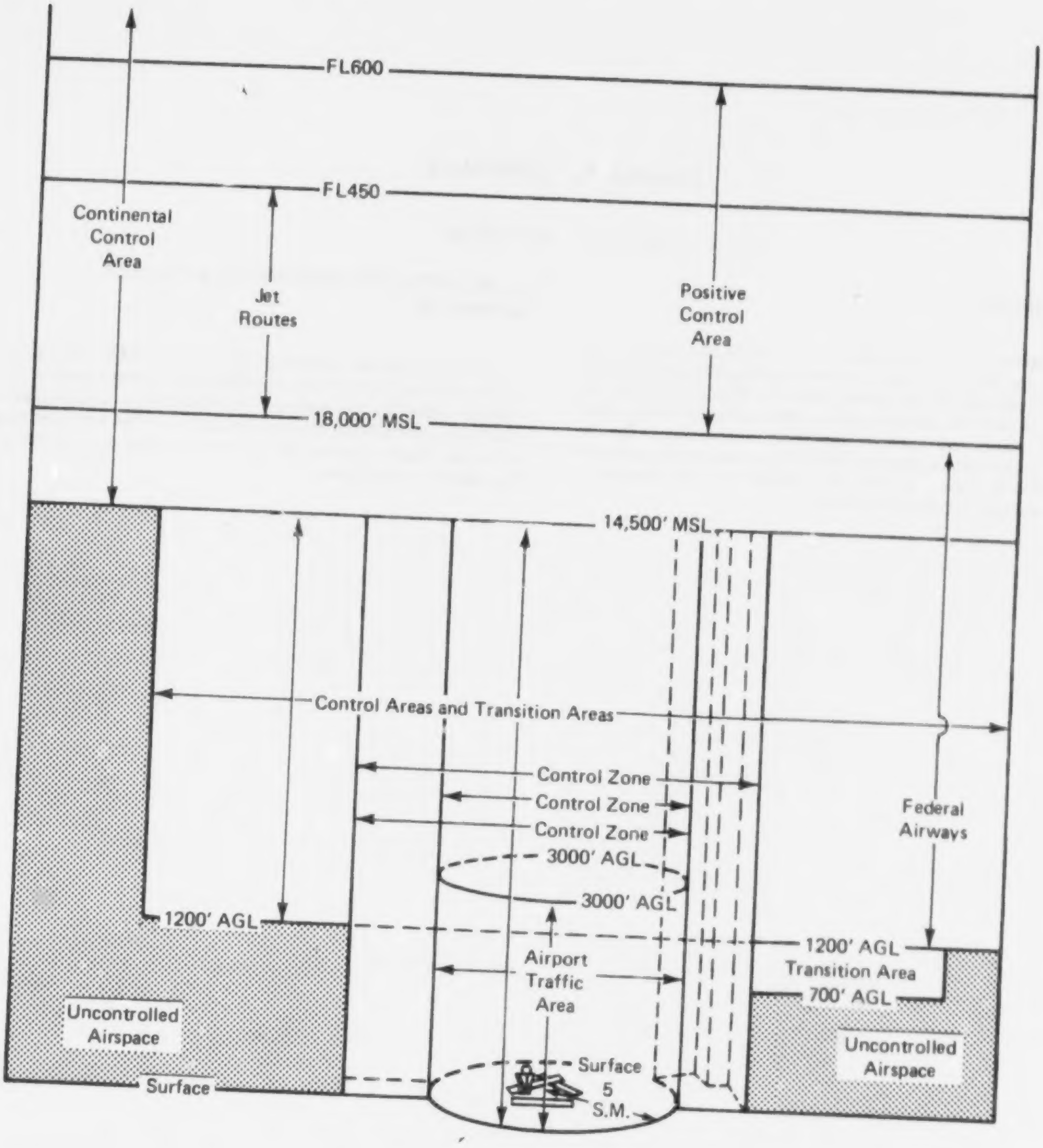
Section 1. GENERAL

70. GENERAL

Airspace users' operations and needs are varied. Because of the nature of some operations, restrictions must be placed upon others for safety reasons. The complexity or density of aircraft movements in other airspace areas may result in additional aircraft and pilot requirements for operation within such airspace. It is of the utmost importance that pilots be familiar with the operational requirements for the various airspace segments.

71. GENERAL DIMENSIONS OF AIRSPACE SEGMENTS

Refer to Federal Aviation Regulations (FARs) for specific dimensions, exceptions, geographical areas covered, exclusions, specific transponder or equipment requirements, and flight operations. Arrows ending near but not touching reference lines mean up to or down to, but not including, the referenced altitude.


FL600
FL450
Continental Control Area
Jet Routes
Positive Control Area
18,000' MSL
14,500' MSL
Control Areas and Transition Areas
Control Zone
Control Zone
Control Zone
Federal Airways
3000' AGL
3000' AGL
1200' AGL
1200' AGL
Transition Area
700' AGL
Airport Traffic Area
Uncontrolled Airspace
Uncontrolled Airspace
Surface
Surface
5 S.M.

72—79. RESERVED

Section 2. UNCONTROLLED AIRSPACE

80. GENERAL

Uncontrolled airspace is that portion of the airspace that has not been designated as Continental Control Area, Control Area, Control Zone, Terminal Control Area, or Transition Area.

81. VFR REQUIREMENTS

Rules governing VFR flight have been adopted to assist the pilot in meeting his responsibility to see and avoid other aircraft. Minimum weather conditions and distance from clouds required for VFR flight are contained in these rules. (FAR—91.105.)

82. IFR REQUIREMENTS

FARs specify the pilot and aircraft equipment requirements for IFR flight. Pilots are reminded that in addition to altitude or flight level requirements, FAR—91.119 includes a requirement to remain at least 1,000 feet (2,000 feet in designated mountainous terrain) above the highest obstacle within a horizontal distance of 5 statute miles from the course to be flown.

83. MINIMUM VFR VISIBILITY AND DISTANCE FROM CLOUDS

ALTITUDE	UNCONTROLLED AIRSPACE		CONTROLLED AIRSPACE	
	Flight Visibility	Distance From Clouds	**Flight Visibility	**Distance From Clouds
1200′ or less above the surface, regardless of MSL Altitude.	*1 statute mile	Clear of clouds	3 statute miles	500′ below 1000′ above 2000′ horizontal
More than 1200′ above the surface, but less than 10,000′ MSL.	1 statute mile	500′ below 1000′ above 2000′ horizontal	3 statute miles	500′ below 1000′ above 2000′ horizontal
More than 1200′ above the surface and at or above 10,000′ MSL.	5 statute miles	1000′ below 1000′ above 1 statute mile horizontal	5 statute miles	1000′ below 1000′ above 1 statute mile horizontal

*Helicopters may operate with less than 1 mile visibility, outside controlled airspace at 1200 feet or less above the surface, provided they are operated at a speed that allows the pilot adequate opportunity to see any air traffic or obstructions in time to avoid collisions.

**In addition, when operating within a control zone beneath a ceiling, the ceiling must not be less than 1000′. If the pilot intends to land or takeoff or enter a traffic pattern within a control zone, the ground visibility must be at least 3 miles at that airport. If ground visibility is not reported at the airport, 3 miles flight visibility is required. (FAR 91.105)

84. ALTITUDES AND FLIGHT LEVELS

CONTROLLED AND UNCONTROLLED AIRSPACE VFR ALTITUDES AND FLIGHT LEVELS

If your magnetic course (ground track) is	More than 3000′ above the surface but below 18,000′ MSL fly	Above 18,000′ MSL to FL 290 (except within Positive Control Area, FAR 71.193) fly	Above FL 290 (except within Positive Control Area, FAR 71.193) fly 4000′ intervals
0° to 179°	Odd thousands, MSL, plus 500′ (3500, 5500, 7500, etc.).	Odd Flight Levels plus 500′ (FL 195, FL 215, FL 235, etc.)	Beginning at FL 300 (FL 300, 340, 380, etc.)
180° to 359°	Even thousands, MSL, plus 500′ (4500, 6500, 8500, etc.).	Even Flight Levels plus 500′ (FL 185, FL 205, FL 225, etc.).	Beginning at FL 320 (FL 320, 360, 400, etc.)

UNCONTROLLED AIRSPACE - IFR ALTITUDES AND FLIGHT LEVELS

If your magnetic course (ground track) is	Below 18,000′ MSL fly	At or above 18,000′ MSL but below FL 290, fly	At or above FL 290, fly 4000′ intervals
0° to 179°	Odd thousands, MSL, (3000, 5000, 7000, etc.).	Odd Flight Levels, FL 190, 210, 230, etc.).	Beginning at FL 290, (FL 290, 330, 370, etc.)
180° to 359°	Even thousands, MSL (2000, 4000, 6000, etc.).	Even Flight Levels (FL 180, 200, 220, etc.).	Beginning at FL 310, (FL 310, 350, 390, etc.)

85—89. RESERVED

Section 3. CONTROLLED AIRSPACE

90. GENERAL

Controlled airspace consists of those areas designated as Continental Control Area, Control Area, Control Zones, Terminal Control Areas, Airport Radar Service Area and Transition Areas, within which some or all aircraft may be subject to ATC. Safety, users' needs, and volume of flight operations are some of the factors considered in the designation of controlled airspace. When so designated, the airspace is supported by ground to air communications, navigation aids, and air traffic services.

91. CONTINENTAL CONTROL AREA

a. The Continental Control Area consists of the airspace of the 48 contiguous States, the District of Columbia and Alaska, excluding the Alaska peninsula west of longitude 160 degrees 00 minutes 00 seconds W, at and above 14,500 feet MSL, but does not include:

(1) The airspace less than 1,500 feet above the surface of the earth; or

(2) Prohibited and Restricted areas, other than the Restricted areas listed in FAR—71 Subpart D.

92. CONTROL AREAS

Control Areas consist of the airspace designated as Colored Federal airways, VOR Federal airways, Additional Control Areas, and Control Area Extensions, but do not include the Continental Control Area. Unless otherwise designated, Control Areas also include the airspace between a segment of a main VOR airway and its associated alternate segments. The vertical extent of the various categories of airspace contained in Control Areas is defined in FAR—71.

93. POSITIVE CONTROL AREA

Positive Control Area is airspace so designated as positive control area in FAR—71.193. This area includes specified airspace within the conterminous U.S. from 18,000 feet to and including FL 600, excluding Santa Barbara Island, Farallon Island, and that portion south of latitude 25 degrees 04 minutes north. In Alaska, it includes the airspace over the State of Alaska from 18,000 feet to and including FL 600, but not including the airspace less than 1,500 feet above the surface of the earth and the Alaskan Peninsula west of longitude 160 degrees 00 minutes west. Rules for operating in Positive Control Area are found in FAR—91.97 and FAR—91.24.

94. TRANSITION AREAS

a. Transition Areas are designated to contain IFR operations in controlled airspace during portions of the terminal operation and while transitioning between the terminal and en route environments.

b. Transition Areas are controlled airspace extending upward from 700 feet or more above the surface when designated in conjunction with an airport for which an instrument approach procedure has been prescribed; or from 1,200 feet or more above the surface when designated in conjunction with airway route structures or segments. Unless specified otherwise, Transition Areas terminate at the base of overlying controlled airspace.

95. CONTROL ZONES

a. Control Zones are regulatory in nature and established as controlled airspace. They extend upward from the surface and terminate at the base of the Continental Control Area. Control Zones that do not underlie the Continental Control Area have no upper limit. A Control Zone is based on a primary airport but may include one or more airports and is normally a circular area within a radius of 5 statute miles around the primary airport, except that it may include extensions necessary to include instrument departure and arrival paths.

b. Some basic requirements for designating a control zone are communications and weather observation reporting:

(1) Communications capability with aircraft which normally operate within the control zone must exist down to the runway surface of the primary airport. Communications may be either direct from the ATC facility having jurisdiction over the control zone or by rapid relay through other communications facilities which are acceptable to that ATC facility.

(2) Federally certificated weather observers take hourly and special weather observations at the primary airport in the control zone during the times and dates a control zone is designated. The required weather observations must be forwarded expeditiously to the ATC facility having jurisdiction over the control zones.

c. Control Zones are depicted on charts (for example, on the Sectional Charts the Control Zone is outlined by a broken blue line). If a Control Zone is effective only during certain hours of the day (a part-time Control Zone as prescribed in the regulation) it will be reflected on the charts. A typical Control Zone is depicted in PARA—71. (See PARA—264 - SPECIAL VFR CLEARANCES.)

96. TERMINAL CONTROL AREA

a. A Terminal Control Area (TCA) consists of controlled airspace extending upward from the surface or higher to specified altitudes, within which **all aircraft** are subject to the operating rules and pilot and equipment requirements specified in FAR—91. TCAs are described in FAR—71. Each TCA location is designated as either a Group I or Group II TCA, and includes at least one primary airport around which the TCA is located. (See FAR—71.12.)

(1) Group I TCAs represent some of the busiest locations in terms of aircraft operations and passengers car-

ried. For reasons of safety it is necessary to have strict requirements for operation within Group I TCAs. (See FAR—91.70(c) and FAR—91.90.)

(2) Group II TCAs represent less busy locations, and though safety dictates some pilot and equipment requirements, requirements are not as stringent as those for Group I locations. (See FAR—91.70(c) and FAR—91.90.)

b. TCAs are charted on Sectional, World Aeronautical, En route Low Altitude, DOD FLIP and TCA Charts.

(1) The following areas are currently designated as Group I TCAs and are depicted on VFR Terminal Area Charts.

Atlanta
Boston
Chicago
Dallas
Los Angeles
Miami
New York
San Francisco
Washington, D.C.

(2) The following areas are currently designated as Group II TCAs and are depicted on VFR Terminal Area Charts.

Cleveland
Denver
Detroit
Honolulu
Houston
Kansas City
Las Vegas
Minneapolis
New Orleans
Philadelphia
Pittsburgh
Seattle
St. Louis
San Diego

97. TERMINAL CONTROL AREA (TCA) OPERATION

a. Operating Rules and Equipment Requirements. Regardless of weather conditions, ATC authorization is required prior to operating within a TCA. Pilots should not request such authorization unless the requirements of FAR—91.24 and FAR—91.90 are met. Included among these requirements are:

(1) Group I TCAs

(a) A two-way radio capable of communicating with ATC on appropriate frequencies.

(b) A VOR or TACAN receiver, except for helicopters.

(c) A 4096 code transponder with MODE C automatic altitude reporting equipment, except for helicopters operating at or below 1,000 feet AGL under a Letter of Agreement.

NOTE.— ATC may, upon notification, immediately authorize a deviation from the altitude reporting equipment requirement; however, request for a deviation from the 4096 transponder equipment requirement must be submitted to the controlling ATC facility at least 1 hour before the proposed operation.

(d) A private pilot certificate or better in order to land or takeoff from an airport within the TCA.

(e) Unless otherwise authorized by ATC, each person operating a large turbine engine powered airplane to or from a primary airport shall operate at or above the designated floors while within the lateral limits of the TCA.

(f) No person may operate an aircraft in the airspace underlying a TCA, at an indicated airspeed of more than 200 knots (230 mph) (FAR—91.70).

(2) Group II TCAs.

(a) A two-way radio capable of communicating with ATC on appropriate frequencies.

(b) A VOR or TACAN receiver, except for helicopters.

(c) A 4096 code transponder, except for helicopters operating at or below 1,000 feet under a Letter of Agreement, or for IFR flights operating to or from an airport outside of but in close proximity to the TCA when the commonly used transition, approach, or departure procedures to such airport require flight within the TCA.

NOTE.— ATC may authorize deviations from the transponder requirements. Requests for deviation must be submitted to the controlling ATC facility at least 1 hour before the proposed operation.

(d) Unless otherwise authorized by ATC, large turbine powered aircraft must operate at or above the floor of the TCA while operating to or from the primary airport.

(e) No person may operate an aircraft in the airspace underlying a TCA, at an indicated airspeed of more than 200 knots (230 mph) (FAR—91.70).

b. Flight Procedures.

(1) *IFR Flights.* Aircraft within the TCA are required to operate in accordance with current IFR procedures. A clearance for a visual approach to a primary airport is not authorization for turbine powered airplanes to operate below the designated floors of the TCA.

(2) *VFR Flights.*

(a) Arriving flights must contact ATC on the appropriate frequency and in relation to geographical fixes shown on local charts. Although a pilot may be operating

beneath the floor of the TCA on initial contact, communications with ATC should be established in relation to the points indicated for spacing and sequencing purposes.

(b) Departing aircraft require a clearance to depart the TCA and should advise the clearance delivery position of their intended altitude and route of flight. ATC will normally advise VFR aircraft when leaving the geographical limits of the TCA. Radar service is not automatically terminated with this advisory unless specifically stated by the controller.

(c) Aircraft not landing or departing the primary airport may obtain ATC clearance to transit the TCA when traffic conditions permit and provided the requirements of FAR—91.90 are met. Such VFR aircraft are encouraged, to the extent possible, to operate at altitudes above or below the TCA or transit through established VFR corridors. Pilots operating in VFR corridors are urged to use frequency 122.750 MHZ for the exchange of aircraft position information.

(d) VFR non-TCA aircraft are cautioned against operating too closely to TCA boundaries, especially where the floor of the TCA is 3,000 feet or less or where VFR cruise altitudes are at or near the floor of higher levels. Observance of this precaution will reduce the potential for encountering a TCA aircraft operating at TCA floor altitudes. Additionally, VFR non-TCA aircraft are encouraged to utilize the VFR Planning Chart as a tool for planning flight in proximity to a TCA. Charted VFR Flyway Planning charts are published on the back of the existing VFR Terminal Area Charts.

c. ATC Clearances and Separation. While operating within a TCA, pilots are provided the service and separation as in Stage III. (See PARA—165 - TERMINAL RADAR PROGRAM FOR VFR AIRCRAFT.) In the event of a radar outage, separation and sequencing of VFR aircraft will be suspended as this service is dependent on radar. The pilot will be advised that the service is not available and issued wind, runway information and the time or place to contact the tower. Traffic information will be provided on a workload permitting basis.

(1) Assignment of radar headings and/or altitudes to aircraft operating in accordance with visual flight rules are based on the provision that a pilot must request an amended clearance if compliance with an assigned route, radar heading or altitude will cause the pilot to violate Basic VFR Weather Minimums.

(2) ATC may assign altitudes to VFR aircraft that do not conform to FAR—91.109. When the altitude assignment is no longer needed for separation or when leaving the TCA, the instruction will be broadcast. "Resume Appropriate VFR Altitudes." Pilots must return to an altitude that conforms to FAR—91.109 as soon as practicable.

98. IFR ALTITUDES AND FLIGHT LEVELS

Pilots operating IFR within controlled airspace will fly at an altitude or flight level assigned by ATC. When operating IFR within controlled airspace with an altitude assignment of **VFR ON TOP**, flight is to be conducted at an appropriate VFR altitude which is not below the minimum IFR altitude for the route. (See PARA—84.) **VFR ON TOP** is not permitted in certain airspace areas, such as positive control airspace, certain Restricted Areas, etc. Consequently, IFR flights operating **VFR ON TOP** will avoid such airspace.

99. RESERVED

100. AIRPORT RADAR SERVICE AREA (ARSA)

a. An Airport Radar Service Area (ARSA) consists of controlled airspace extending upward from the surface or higher to specified altitudes, within which all aircraft are subject to the operating rules and pilot and equipment requirments specified in FAR—91. ARSAs are described in FAR—71. (See FAR—71.14.)

b. Dimensions

(1) *ARSA* (A basic standard design with minor site specific variations.) The ARSA airspace consists of two circles, both centered on the primary/ARSA airport. The inner circle has a radius of 5NM. The outer circle has a radius of 10NM. The airspace of the inner circle extends from the surface of the ARSA airport up to 4,000 feet above that airport. The airspace area between the 5 and 10NM rings begins at a height 1,200 feet AGL and extends to the same altitude cap as the inner circle.

(2) *OUTER AREA* The normal radius will be 20NM, with some variations based on site specific requirements. The outer area extends outward from the primary/ARSA airport and extends from the lower limits of radar/radio coverage up to the ceiling of the approach control's delegated airspace, excluding the ARSA and other airspace as appropriate.

c. ARSAs are charted on Sectional Charts, and some Terminal Control Area Charts.

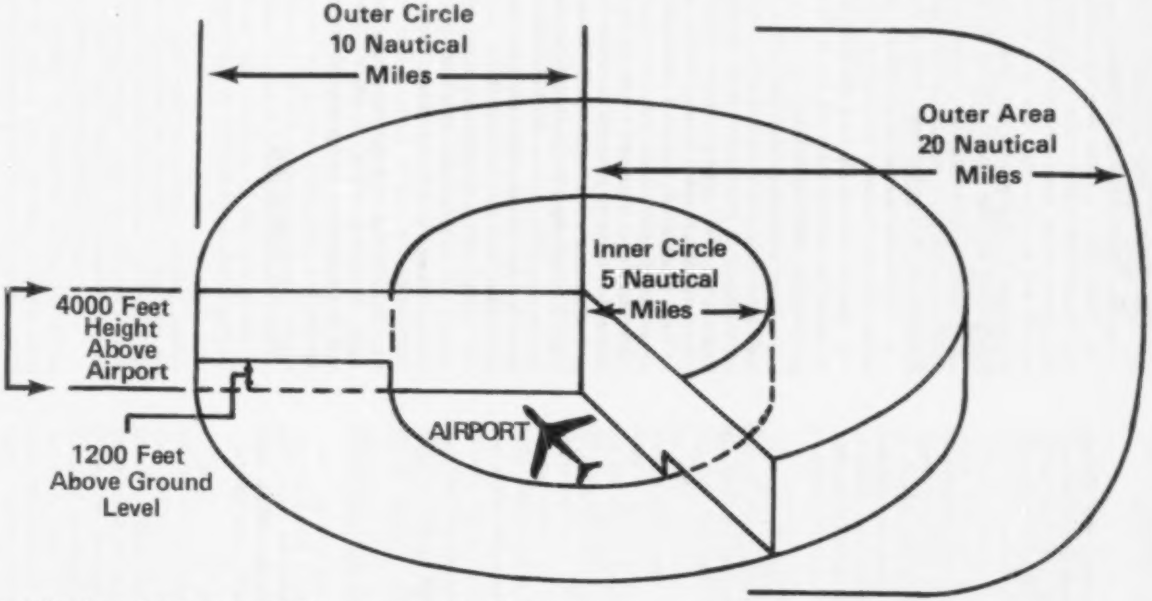
(1) The following areas are currently designated as ARSAs and are depicted on Sectional Charts.

STATE	CITY
ALABAMA	Birmingham
ALASKA	Anchorage
ARKANSAS	Little Rock
CALIFORNIA	Beale AFB
	Burbank
	Castle AFB (Merced)
	El Toro MCAS
	March AFB
	Mather AFB

STATE	CITY
	McClellan AFB
	Norton
	Ontario
	Sacramento
CONNECTICUT	Windsor Locks (Bradley)
FLORIDA	Pensacola
	Whiting NAS
	Pensacola NAS
	Daytona Beach
	Ft. Lauderdale
	Jacksonville
	Orlando
	West Palm Beach
	Tampa
GEORGIA	Columbus
INDIANA	South Bend
IOWA	Des Moines
MARYLAND	Baltimore
NEBRASKA	Omaha
	Offutt AFB
NEW YORK	Albany
	Buffalo
	Islip
	Syracuse
NORTH CAROLINA	Charlotte
	Greensboro
OKLAHOMA	Tulsa
	Oklahoma City
	Tinker AFB
OHIO	Columbus
	Dayton
OREGON	Portland
TENNESSEE	Memphis
	Nashville
TEXAS	Austin
	Corpus Christi
	El Paso
	Lubbock
	San Antonio
UTAH	Salt Lake City
VERMONT	Burlington
VIRGINIA	Norfolk
	Richmond
WISCONSIN	Milwaukee

This list will be updated as additional ARSAs are implemented. Pilots should consult current sectional cha and NOTAMs for the latest information on services available. Pilots should be aware that some ARSAs under or are adjacent to TCAs.

Airport Radar Service Area (ARSA)


Outer Circle
10 Nautical
Miles
Outer Area
20 Nautical
Miles
Inner Circle
5 Nautical
Miles
4000 Feet
Height
Above
Airport
1200 Feet
Above Ground
Level
AIRPORT

Services upon establishing two-way radio communication and radar contact:

Sequencing Arrivals

IFR/IFR Standard Separation

IFR/VFR Traffic Advisories and Conflict Resolution

VFR/VFR Traffic Advisories

Note: The normal radius of the Outer Area, will be 20nm, with some site specific variations.

IFR: Instrument Flight Rules
VFR: Visual Flight Rules

101. AIRPORT RADAR SERVICE AREA (ARSA) OPERATION

a. Operating Rules and Pilot/Equipment Requirements

(1) Pilot Certification: Student Pilot or better.

(2) Equipment: Two-Way Radio.

(3) Arrivals and Overflights: No person may operate an aircraft in an airport radar service area unless two-way radio communication is established with ATC prior to entering that ARSA and is thereafter maintained with ATC, while within that area.

(4) Departures:

(a) Primary Airport: No person may operate an aircraft within the ARSA unless two-way radio communication is maintained with ATC while within that ARSA.

(b) Satellite Airports: Aircraft departing satellite airports/heliports within the ARSA surface area shall establish two-way communication with ATC as soon as possible. Pilots must comply with approved FAA traffic patterns when departing these airports.

(5) ULTRALIGHT VEHICLES: No person may operate an ultralight vehicle within an airport radar service area unless that person has prior authorization from the air traffic control facility having jurisdiction over that airspace. (FAR—103)

(6) Parachute Jumps: No person may make a parachute jump and no pilot in command may allow a parachute jump to be made from that aircraft in or into an airport radar service area without, or in violation of, the terms of an ATC authorization. (FAR—105)

b. ATC Services

(1) Within The ARSA:

(a) Sequencing of all arriving aircraft to the primary/ARSA airport.

(b) Standard IFR separation between IFR aircraft.

(c) Between IFR and VFR aircraft - traffic advisories and conflict resolution so that radar targets do not touch, or 500 feet vertical separation.

(d) Between VFR aircraft - traffic advisories and as appropriate, safety alerts.

(2) Within The Outer Area:

(a) The same services are provided for aircraft operating within the outer area, as within the ARSA, *when two-way communication and radar contact is established.*

(b) While pilot participation in this area is strongly encouraged, it is not a VFR requirement.

(3) Beyond The Outer Area:

(a) Standard IFR separation.

(b) Basic Radar Service.

(c) Stage II/Stage III Service, where appropriate.

(d) Safety Alert, as appropriate.

c. Since this is a radar program ARSA services will only be provided within radar/radio coverage. In the event of a radar outage, separation and sequencing of VFR aircraft will be suspended. The pilot will be advised that the service is not available and issued wind, runway information and the time to contact the tower.

d. While pilot participation is required within the ARSA, it is voluntary within the outer area and can be discontinued, within the outer area, at the pilots request.

e. ARSA services will be provided in the outer area unless the pilot requests termination of the service.

f. Service provided beyond the outer area will be on a workload permitting basis and can be terminated by the controller if workload dictates.

g. In some locations an ARSA may overlap the airport traffic area of a secondary airport. In order to allow that control tower to provide service to aircraft, portions of the overlapping ARSA may be procedurally excluded when the secondary airport tower is in operation. Aircraft operating in these procedurally excluded areas will only be provided airport traffic control services when in communication with the secondary airport tower. ARSA service to aircraft inbound to these airports will be discontinued when the aircraft is instructed to contact the tower.

h. Aircraft departing secondary controlled airports will not receive ARSA service until they have been radar identified and two-way communication has been established with the ARSA facility.

i. ARSA service to aircraft proceeding to a satellite airport will be terminated at a sufficient distance to allow time to change to the appropriate tower or advisory frequency.

j. Some ARSA facilities shut down for portions of the night. When this occurs, the effective hours of the ARSA will be the same as the operating hours of the serving facility.

102—109. RESERVED

Section 4. SPECIAL USE AIRSPACE

110. GENERAL

Special use airspace consists of that airspace wherein activities must be confined because of their nature, or wherein limitations are imposed upon aircraft operations that are not a part of those activities, or both. Except for Controlled Firing Areas, special use airspace areas are depicted on aeronautical charts.

111. PROHIBITED AREA

Prohibited Areas contain airspace of defined dimensions identified by an area on the surface of the earth within which the flight of aircraft is prohibited. Such areas are established for security or other reasons associated with the national welfare. These areas are published in the Federal Register and are depicted on aeronautical charts.

112. RESTRICTED AREA

a. Restricted Areas contain airspace identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Activities within these areas must be confined because of their nature or limitations imposed upon aircraft operations that are not a part of those activities or both. Restricted areas denote the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. Penetration of Restricted Areas without authorization from the using or controlling agency may be extremely hazardous to the aircraft and its occupants. Restricted Areas are published in the Federal Register and constitute FAR—73.

b. ATC facilities apply the following procedures when aircraft are operating on an IFR clearance (including those cleared by ATC to maintain VFR ON TOP) via a route which lies within joint-use restricted airspace.

(1) If the restricted area is not active and has been released to the controlling agency (FAA), the ATC facility will allow the aircraft to operate in the restricted airspace without issuing specific clearance for it to do so.

(2) If the restricted area is active and has not been released to the controlling agency (FAA), the ATC facility will issue a clearance which will ensure the aircraft avoids the restricted airspace unless it is on an approved altitude reservation mission or has obtained its own permission to operate in the airspace and so informs the controlling facility.

NOTE.— The above apply only to joint-use restricted airspace and not to prohibited and nonjoint-use airspace. For the latter categories, the ATC facility will issue a clearance so the aircraft will avoid the restricted airspace unless it is on an approved altitude reservation mission or has obtained its own permission to operate in the airspace and so informs the controlling facility.

c. Restricted airspace is depicted on the En Route Chart appropriate for use at the altitude or flight level being flown. For joint-use restricted areas, the name of the controlling agency is shown on these charts. For all prohibited areas and nonjoint-use restricted areas, unless otherwise requested by the using agency, the phrase "NO A/G" is shown.

113. WARNING AREA

Warning Areas are airspace which may contain hazards to nonparticipating aircraft in international airspace. Warning Areas are established beyond the 3 mile limit. Though the activities conducted within Warning Areas may be as hazardous as those in Restricted Areas, Warning Areas cannot be legally designated as Restricted Areas because they are over international waters. Penetration of Warning Areas during periods of activity may be hazardous to the aircraft and its occupants. Official descriptions of Warning Areas may be obtained on request to the FAA, Washington, D.C.

114. MILITARY OPERATIONS AREAS (MOA)

a. MOAs consist of airspace of defined vertical and lateral limits established for the purpose of separating certain military training activities from IFR traffic. Whenever a MOA is being used, nonparticipating IFR traffic may be cleared through a MOA if IFR separation can be provided by ATC. Otherwise, ATC will reroute or restrict nonparticipating IFR traffic.

b. Most training activities necessitate acrobatic or abrupt flight maneuvers. Military pilots conducting flight in Department of Defense aircraft within a designated and active military operations area (MOA) are exempted from the provisions of FAR 91.71(c) and (d) which prohibit acrobatic flight within Federal airways and control zones.

c. Pilots operating under VFR should exercise extreme caution while flying within a MOA when military activity is being conducted. The activity status (active/inactive) of MOA's may change frequently. Therefore, pilots should contact any FSS within 100 miles of the area to obtain accurate real-time information concerning the MOA hours of operation. Prior to entering an active MOA, pilots should contact the controlling agency for traffic advisories.

d. MOA's are depicted on Sectional, VFR Terminal, Area and Low Altitude En Route Charts.

115. ALERT AREA

Alert Areas are depicted on aeronautical charts to inform nonparticipating pilots of areas that may contain a high volume of pilot training or an unusual type of aerial activity. Pilots should be particularly alert when flying in these areas. All activity within an Alert Area shall be conducted in accordance with FARs, without waiver, and pilots of participating aircraft as well as pilots transiting the area shall be equally responsible for collision avoidance. Information concerning these areas may be obtained upon request to the FAA, Washington, D.C.

116. CONTROLLED FIRING AREAS

Controlled Firing Areas contain activities which, if not conducted in a controlled environment, could be hazardous to nonparticipating aircraft. The distinguishing feature of the Controlled Firing Area, as compared to other special use airspace, is that its activities are suspended immediately when spotter aircraft, radar, or ground lookout positions indicate an aircraft might be approaching the area. There is no need to chart Controlled Firing Areas since they do not cause a nonparticipating aircraft to change its flight path.

117. PARACHUTE JUMP AIRCRAFT OPERATIONS

a. Procedures relating to parachute jump areas are co tained in FAR—105. Tabulations of parachute jump are in the U.S. are contained in the Airport/Facility Director

b. Pilots of aircraft engaged in parachute jump op ations are reminded that all reported altitudes must with reference to mean sea level, or flight level, as appr priate, to enable ATC to provide meaningful traffic inf mation.

118—129. RESERVED

Section 5. OTHER AIRSPACE AREAS

130. AIRPORT TRAFFIC AREAS

a. Unless otherwise specifically designated (FAR—93), Airport traffic areas consist of the airspace within a horizontal radius of 5 statute miles from the geographical center of any airport at which a control tower is operating, extending from the surface up to, but not including, an altitude of 3,000 feet above the elevation of the airport.

b. The rules prescribed for airport traffic areas are established in FAR—91.70, FAR—91.85, and FAR—91.87. They require, in effect, that unless a pilot is landing or taking off from an airport within the airport traffic area, *the pilot must avoid the area unless specifically authorized by ATC*, either directly from the ATC facility responsible for the airport traffic area, or from the facility from which the pilot is receiving radar services. When authorized by ATC to operate in an airport traffic area, the pilot may expect traffic advisory service on a workload-permitting basis.

c. Unless otherwise authorized, a pilot operating to or from an airport served by a control tower must: (1) establish and maintain radio communications with the tower prior to and while operating in the airport traffic area, (2) Maintain radio communications with the tower while operating on the movement areas of the airport. Maximum indicated airspeeds are prescribed. Airport traffic areas are indicated on VFR Navigation Charts by the blue airport symbol, but the actual boundary is not depicted. (See PARA—71 - GENERAL DIMENSIONS OF AIRSPACE SEGMENTS.)

131. AIRPORT ADVISORY AREA

a. The airport advisory area is the area within 10 statute miles of an airport where a control tower is not operating but where a FSS is located. At such locations, the FSS provides advisory service to arriving and departing aircraft. (See PARA—157 - TRAFFIC AIRPORT ADVISORY PRACTICES AT AIRPORTS WHERE A TOWER IS NOT IN OPERATION.)

b. It is not mandatory that pilots participate in the Airport Advisory Service program, but it is strongly recommended that they do.

132. MILITARY TRAINING ROUTES (MTR)

a. National security depends largely on the deterrent effect of our airborne military forces. To be proficient, the military services must train in a wide range of airborne tactics. One phase of this training involves "low level" combat tactics. The required maneuvers and high speeds are such that they may occasionally make the see-and-avoid aspect of VFR flight more difficult without increased vigilance in areas containing such operations. In an effort to ensure the greatest practical level of safety for all flight operations, the MTR program was conceived.

b. The MTRs program is a joint venture by the FAA and the Department of Defense (DOD). MTR routes are mutually developed for use by the military for the purpose of conducting low-altitude, high-speed training. The routes above 1,500 feet above ground level (AGL) are developed to be flown, to the maximum extent possible, under IFR. The routes at 1,500 feet AGL and below are generally developed to be flown under Visual Flight Rules (VFR).

c. Generally, MTRs are established below 10,000 feet MSL for operations at speeds in excess of 250 knots. However, route segments may be defined at higher altitudes for purposes of route continuity. For example, route segments may be defined for descent, climbout, and mountainous terrain. There are IFR and VFR routes as follows:

(1) IFR Military Training Routes — IR: Operations on these routes are conducted in accordance with IFRs regardless of weather conditions.

(2) VFR Military Training Routes — VR: Operations on these routes are conducted in accordance with VFRs.

d. Military training routes will be identified and charted as follows:

(1) Route identification.

(a) *IR and VR at or below 1,500 feet AGL* (with no segment above 1,500) will be identified by four digit numbers; e.g., IR 1006, VR 1007, etc.

(b) *IR and VR above 1,500 feet AGL* (segments of these routes may be below 1,500) will be identified by three digit numbers; e.g., IR 008, VR 009, etc.

(c) Alternate IR/VR routes or route segments are identified by using the basic/principal route designation followed by a letter suffix, e.g., IR008A, VR1007B, etc.

(2) Route charting.

(a) IFR Low Altitude En Route Chart — This chart will depict all IR routes and all VR routes that accommodate operations above 1,500 feet AGL.

(b) VFR Planning Chart — This chart will depict routes (military training activities such as IR and VR regardless of altitude@, MOAs, and restricted, warning and alert areas.

(c) Area Planning (AP/1B) Chart (DOD Flight Information Publication — FLIP. This chart is published by the DOD primarily for military users and contains detailed information on both IR and VR routes. (See PARA—625 - AUXILIARY CHARTS.)

e. The FLIP contains charts and narrative descriptions of these routes. This publication is available to the general public by single copy or annual subscription from the NOAA Distribution Branch, N/CG33 Riverdale, Maryland 20849. This DOD FLIP is available for pilot briefings at FSS and many airports.

f. Nonparticipating aircraft are not prohibited from flying within an MTR; however, extreme vigilance should be exercised when conducting flight through or near these routes. Pilots should contact FSSs within 100 NM of a particular MTR to obtain current information or route usage in their vicinity. Information available includes times of

scheduled activity, altitudes in use on each route segment, and actual route width. Route width varies for each MTR and can extend several miles on either side of the charted MTR centerline. Route width information for IR and VR MTR's is also available in the FLIP AP/1B along with additional MTR (SR/AR) information. When requesting MTR information, pilots should give the FSS their position, route of flight, and destination in order to reduce frequency congestion and permit the FSS specialist to identify the MTR routes which could be a factor.

133. TEMPORARY FLIGHT RESTRICTIONS

a. Temporary flight restrictions may be put into effect in the vicinity of any incident or event which by its nature may generate such a high degree of public interest that the likelihood of a hazardous congestion of air traffic exists. FAR—91.91, as amended, prohibits the operation of nonessential aircraft in airspace that has been designated in a NOTAM as an area within which temporary flight restrictions apply. This rule will be implemented in the case of disasters of substantial magnitude. It will also be implemented as necessary in the case of demonstrations, riots, and other civil disturbances, as well as major sporting events, parades, pageants, and similar functions which are likely to attract large crowds and encouraging viewing from the air. (See PARA—294 — NOTICE TO AIRMEN (NOTAM) SYSTEM.)

b. NOTAM's implementing temporary flight restrictions will contain a description of the area in which the restrictions apply. Normally the area will include the airspace below 2,000 feet above the surface within 5 miles of the site of the incident. However, the exact dimensions will be included in the NOTAM.

c. Pilots are not to operate aircraft within such an area described in the NOTAM unless they are one of the following:

(1) That aircraft is participating in disaster relief activities and is being operated under the direction of the agency responsible for relief activities;

(2) They are operating to or from an airport within the area and such operation will not hamper or endanger relief activities;

(3) Their operation is authorized under an IFR ATC clearance;

(4) Flight around the area is impracticable because of weather or other considerations and advance notice is given to the Air Traffic facility specified in the NOTAM and en route flight through the area will not hamper or endanger relief activities; or

(5) They are carrying accredited news representatives or persons on official business concerning the incident, and the flight is conducted in accordance with FAR—91.79 and a flight plan is filed with the Air Traffic facility specified in the NOTAM.

d. Flight Limitations in the proximity of Space Flight Operations are designated in a Notice to Airmen (NOTAM). FAR—91.102 provides protection from potentially hazardous situations for pilots and space flight crews and costly delays of shuttle operations.

e. Flight Restrictions in the proximity of Presidential and Other Parties are put into effect because numerous aircraft and large assemblies of persons may be attracted to areas to be visited or traveled by the President or Vice President, heads of foreign states, and other public figures. Such conditions may create a hazard to aircraft engaged in air commerce and to persons and property on the ground. In addition, responsible agencies of the United States Government may determine that certain regulatory actions should be taken in the interest of providing protection for these public figures. FAR—91.104 provides for the issuance of a regulatory NOTAM to establish flight restrictions where required in such cases.

134—149. RESERVED

Chapter 4. AIR TRAFFIC CONTROL

Section 1. SERVICES AVAILABLE TO PILOTS

150. AIR ROUTE TRAFFIC CONTROL CENTERS

Centers are established primarily to provide Air Traffic Service to aircraft operating on IFR flight plans within controlled airspace, and principally during the en route phase of flight.

151. CONTROL TOWERS

Towers have been established to provide for a safe, orderly and expeditious flow of traffic on and in the vicinity of an airport. When the responsibility has been so delegated, towers also provide for the separation of IFR aircraft in the terminal areas (See PARA—362 - APPROACH CONTROL.)

152. FLIGHT SERVICE STATIONS

FSSs are air traffic facilities which provide pilot briefings, en route communications and VFR search and rescue services, assist lost aircraft and aircraft in emergency situations, relay ATC clearances, originate Notices to Airmen, broadcast aviation weather and NAS information, receive and process IFR flight plans, and monitor NAVAIDS. In addition, at selected locations FSSs provide En Route Flight Advisory Service (Flight Watch), take weather observations, issue airport advisories, and advise Customs and Immigration of transborder flights.

153. RECORDING AND MONITORING

a. Calls to air traffic control (ATC) facilities (ARTCCs, Towers, FSSs, Central Flow, and Operations Centers) over radio and ATC operational telephone lines (lines used for operational purposes such as controller instructions, briefings, opening and closing flight plans, issuance of IFR clearances and amendments, counter hijacking activities, etc.) may be monitored and recorded for operational uses such as accident investigations, accident prevention, search and rescue purposes, specialist training and evaluation, and technical evaluation and repair of control and communications systems.

b. Where the public access telephone is recorded, a beeper tone is not required. In place of the "beep" tone the FCC has substituted a mandatory requirement that persons to be recorded be given notice they are to be recorded and give consent. Notice is given by this entry, consent to record is assumsed by the individual placing a call to the operational facility.

154. COMMUNICATIONS RELEASE OF IFR AIRCRAFT LANDING AT AN AIRPORT NOT BEING SERVED BY AN OPERATING TOWER

Aircraft operating on an IFR flight plan, landing at an airport not being served by a tower will be advised to change to the airport advisory frequency when direct communications with ATC is no longer required. Towers and centers do not have nontower airport traffic and runway in use information. The instrument approach may not be aligned with the runway in use; therefore, if the information has not already been obtained, pilots should make an expeditious change to the airport advisory frequency when authorized. (See PARA—363-ADVANCE INFORMATION ON INSTRUMENT APPROACH.)

155. PILOT VISITS TO AIR TRAFFIC FACILITIES

Pilots are encouraged to visit air traffic facilities (Towers, Centers and FSSs) and participate in "Operation Raincheck". Operation Raincheck is a program designed to familiarize pilots with the ATC system, its functions, responsibilities and benefits. On rare occasions, facilities may not be able to approve a visit because of ATC workload or other reasons. It is therefore requested that pilots contact the facility prior to the visit and advise of the number of persons in the group, the time and date of the proposed visit and the primary interest of the group. With this information available, the facility can prepare an itinerary and have someone available to guide the group through the facility.

156. APPROACH CONTROL SERVICE FOR VFR ARRIVING AIRCRAFT

a. Numerous approach control facilities have established programs for arriving VFR aircraft to contact approach control for landing information. This information includes: wind, runway, and altimeter setting at the airport of intended landing. This information may be omitted if contained in the ATIS broadcast and the pilot states the appropriate ATIS code.

NOTE.— Pilot use of "have numbers" does not indicate receipt of the ATIS broadcast. In addition, the controller will provide traffic advisories on a workload permitting basis.

b. Such information will be furnished upon initial contact with concerned approach control facility. The pilot will be requested to change to the *tower* frequency at a predetermined time or point, to receive further landing information.

c. Where available, use of this procedure will not hinder the operation of VFR flights by requiring excessive spacing between aircraft or devious routing.

d. Compliance with this procedure is not mandatory but pilot participation is encouraged. (See PARA—165-TERMINAL RADAR PROGRAMS FOR VFR AIRCRAFT.)

157. TRAFFIC ADVISORY PRACTICES AT AIRPORTS WITHOUT OPERATING CONTROL TOWERS

a. Airport Operations Without Operating Control Tower

(1) There is no substitute for alertness while in the vicinity of an airport. It is essential that pilots be alert and look for other traffic and exchange traffic information when approaching or departing an airport without an operating control tower. This is of particular importance since other aircraft may not have communication capability or, in some cases, pilots may not communicate their presence or intentions when operating into or out of such airports. To achieve the greatest degree of safety, it is essential that all radio-equipped aircraft transmit/receive on a common frequency identified for the purpose of airport advisories.

(2) An airport may have a full or part-time tower or flight service station (FSS) located on the airport, a full or part-time UNICOM station or no aeronautical station at all. There are three ways for pilots to communicate their intention and obtain airport/traffic information when operating at an airport that does not have an operating tower: by communicating with an FSS, a UNICOM operator, or by making a self-announce broadcast.

b. Communicating on a Common Frequency.

(1) The key to communicating at an airport without an operating control tower is selection of the correct common frequency. The acronym *CTAF* which stands for Common Traffic Advisory Frequency, is synonymous with this program. A CTAF is a frequency designated for the purpose of carrying out airport advisory practices while operating to or from an airport without an operating control tower. The CTAF may be a UNICOM, MULTICOM, FSS, or tower frequency and is identified in appropriate aeronautical publications.

(2) The CTAF frequency for a particular airport is contained in the Airport/Facility Directory (A/FD), Alaska Supplement, Alaska Terminal Publication, Instrument Approach Procedure Charts, and Standard Instrument Departure (SID) charts. Also, the CTAF frequency can be obtained by contacting any FSS. Use of the appropriate CTAF, combined with a visual alertness and application of the following recommended good operating practices, will enhance safety of flight into and out of all uncontrolled airports.

c. Recommended Traffic Advisory Practices.

All inbound traffic should monitor and communicate as appropriate on the designated CTAF from 10 miles to landing. Departing aircraft should monitor/communicate on the appropriate frequency from start-up, during taxi, and until 10 miles from the airport unless the FARs or local procedures require otherwise.

d. Airport Advisory Service Provided by an FSS.

(1) Airport Advisory Service (AAS) is a service provided by an FSS physically located on an airport which does not have a control tower or where the tower is operated on a part-time basis. The CTAF for FSSs which provide this service will be disseminated in appropriate aeronautical publications.

(2) In communicating with a CTAF FSS, establish two-way communications before transmitting outbound/inbound intentions or information. An inbound aircraft should report approximately 10 miles from the airport, reporting altitude and aircraft type, location relative to the airport, state whether landing or overflight, and request airport advisory. Departing aircraft should state the aircraft type, full identification number, type of flight planned, i.e., VFR or IFR and the planned destination or direction of flight. Report before taxiing and before taxiing on the runway for departure. If communications with a UNICOM are necessary after initial report to FSS, return to FSS frequency for traffic update.

(a) Inbound

EXAMPLE:

VERO BEACH RADIO, CENTURION SIX NINER DELTA DELTA IS TEN MILES SOUTH, TWO THOUSAND, LANDING VERO BEACH. REQUEST AIRPORT ADVISORY.

(b) Outbound

EXAMPLE:

VERO BEACH RADIO, CENTURION SIX NINER DELTA DELTA, READY TO TAXI, VFR, DEPARTING TO THE SOUTHWEST. REQUEST AIRPORT ADVISORY.

(3) A CTAF FSS provides wind direction and velocity, favored or designated runway, altimeter setting, known traffic, notices to airmen, airport taxi routes, airport traffic pattern information, and instrument approach procedures. These elements are varied so as to best serve the current traffic situation. Some airport managers have specified that under certain wind or other conditions designated runways be used. Pilots should advise the FSS of the runway they intend to use.

CAUTION: All aircraft in the vicinity of an airport may not be in communication with the FSS.

e. Information Provided by Aeronautical Advisory Stations (UNICOM).

(1) UNICOM is a nongovernment air/ground radio communication station which may provide airport information at public use airports where there is no tower or FSS.

(2) On pilot request, UNICOM stations may provide pilots with weather information, wind direction, the recommended runway, or other necessary information. If the UNICOM frequency is designated as the CTAF, it will be identified in appropriate aeronautical publications.

(3) Should AAS by an FSS or, Aeronautical Advisory Station (UNICOM) be unavailable, wind and weather information may be obtainable from nearby controlled airports via Automatic Terminal Information Service (ATIS) or Automated Weather Observing System (AWOS) frequency.

f. Self-Announce Position and/or Intentions.

(1) General. *Self-announce* is a procedure whereby pilots broadcast their position or intended flight activity or ground operation on the designated CTAF. This procedure is used primarily at airports which do not have an FSS on the airport. The self-announce procedure should also be used if a pilot is unable to communicate with the FSS on the designated CTAF.

(2) If an airport has a tower and it is temporarily closed, or operated on a part-time basis and there is no FSS on the airport or the FSS is closed, use the CTAF to self-announce your position or intentions.

(3) Where there is no tower, FSS, or UNICOM station on the airport, use MULTICOM frequency 122.9 for self-announce procedures. Such airports will be identified in appropriate aeronautical information publications.

(4) Practice Approaches. Pilots conducting practice instrument approaches should be particularly alert for other aircraft that may be departing in the opposite direction. When conducting any practice approach, regardless of its direction relative to other airport operations, pilots should make announcements on the CTAF as follows:

(a) departing the final approach fix, inbound (non precision approach) or departing the outer marker or fix used in lieu of the outer marker, inbound (precision approach);

(b) established on the final approach segment or immediately upon being released by ATC;

(c) upon completion or termination of the approach; and

(d) upon executing the missed approach procedure.

(5) Departing aircraft should always be alert for arrival aircraft coming from the opposite direction.

(6) Recommended Self—Announce Phraseologies: It should be noted that aircraft operating to or from another nearby airport may be making self-announce broadcasts on the same UNICOM or MULTICOM frequency. To help identify one airport from another, the airport name should be spoken at the beginning and end of each self-announce transmission.

(a) Inbound

EXAMPLE:

STRAWN TRAFFIC, APACHE TWO TWO FIVE ZULU, (POSITION), (ALTITUDE), (DESCENDING) OR ENTERING DOWNWIND/BASE/FINAL (AS APPROPRIATE) RUNWAY ONE SEVEN FULL STOP, TOUCH-AND-GO, STRAWN.

STRAWN TRAFFIC APACHE TWO TWO FIVE ZULU LEAVING RUNWAY ONE SEVEN STRAWN.

(b) Outbound

EXAMPLE:

STRAWN TRAFFIC, QUEEN AIR SEVEN ONE FIVE FIVE BRAVO (LOCATION ON AIRPORT) TAXIING TO RUNWAY TWO SIX STRAWN.

STRAWN TRAFFIC, QUEEN AIR SEVEN ONE FIVE FIVE BRAVO DEPARTING RUNWAY TWO SIX. "DEPARTING THE PATTERN TO THE (DIRECTION), CLIMBING TO (ALTITUDE) STRAWN."

(c) Practice Instrument Approach

EXAMPLE:

STRAWN TRAFFIC, CESSNA TWO ONE FOUR THREE QUEBEC (NAME - FINAL APPROACH FIX) INBOUND DESCENDING THROUGH (ALTITUDE) PRACTICE (TYPE) APPROACH RUNWAY THREE FIVE STRAWN.

STRAWN TRAFFIC, CESSNA TWO ONE FOUR THREE QUEBEC PRACTICE (TYPE) APPROACH COMPLETED OR TERMINATED RUNWAY THREE FIVE STRAWN.

g. UNICOM Communications Procedures.

(1) In communicating with a UNICOM station, the following practices will help reduce frequency congestion, facilitate a better understanding of pilot intentions, help identify the location of aircraft in the traffic pattern, and enhance safety of flight:

(a) Select the correct UNICOM frequency.

(b) State the identification of the UNICOM station you are calling in each transmission.

(c) Speak slowly and distinctly.

(d) Report approximately 10 miles from the airport, reporting altitude, and state your aircraft type, aircraft idenification, location relative to the airport, state whether landing or overflight, and request wind information and runway in use.

(e) Report on downwind, base, and final approach.

(f) Report leaving the runway.

(2) Recommended UNICOM Phraseologies:

(a) Inbound

EXAMPLE:

FREDERICK UNICOM CESSNA EIGHT ZERO ONE TANGO FOXTROT 10 MILES SOUTHEAST DESCENDING THROUGH (ALTITUDE) LANDING FREDERICK, REQUEST WIND AND RUNWAY INFORMATION FREDERICK.

FREDERICK TRAFFIC CESSNA EIGHT ZERO ONE TANGO FOXTROT ENTERING DOWNWIND/BASE/FINAL (AS APPROPRIATE) FOR RUNWAY ONE NINE FULL STOP, TOUCH-AND-GO FREDERICK.

FREDERICK TRAFFIC CESSNA EIGHT ZERO ONE TANGO FOXTROT LEAVING RUNWAY ONE NINE FREDERICK.

(b) Outbound

EXAMPLE:

FREDERICK UNICOM CESSNA EIGHT ZERO ONE TANGO FOXTROT (LOCATION ON AIRPORT) TAXIING TO RUNWAY ONE NINE, REQUEST WIND AND TRAFFIC INFORMATION FREDERICK.

FREDERICK TRAFFIC CESSNA EIGHT ZERO ONE TANGO FOXTROT DEPARTING RUNWAY ONE NINE. "REMAINING IN THE PATTERN" OR "DEPARTING THE PATTERN TO THE (DIRECTION) (AS APPROPRIATE)" FREDERICK.

SUMMARY OF RECOMMENDED COMMUNICATION PROCEDURES

	FACILITY AT AIRPORT	FREQUENCY USE	COMMUNICATION/BROADCAST PROCEDURES		
			OUTBOUND	*INBOUND*	*PRACTICE INSTRUMENT APPROACH*
1.	UNICOM (No Tower or FSS)	Communicate with UNICOM station on published CTAF frequency (122.7, 122.8, 122.725, 122.975, or 123.0). If unable to contact UNICOM station, use self-announce procedures on CTAF.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	
2.	No Tower, FSS, or UNICOM	Self-announce on MULTICOM frequency 122.9.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	Departing final approach fix (name) or on final approach segment inbound.
3.	No Tower in operation, FSS open	Communicate with FSS on CTAF frequency.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	Approach completed/terminated.
4.	FSS closed (No Tower)	Self-announce on CTAF.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	
5.	Tower or FSS not in operation	Self-announce on CTAF.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	

158. IFR APPROACHES/GROUND VEHICLE OPERATIONS

a. IFR Approaches.

When operating in accordance with an IFR clearance and ATC approves a change to the advisory frequency, make an expeditious change to the CTAF and employ the recommended traffic advisory procedures.

b. Ground Vehicle Operation.

Airport ground vehicles equipped with radios should monitor the CTAF frequency when operating on the airport movement area and remain clear of runways/taxiways being used by aircraft. Radio transmissions from ground vehicles should be confined to safety-related matters.

c. Radio Control of Airport Lighting Systems.

Whenever possible, the CTAF will be used to control airport lighting systems at airports without operating control towers. This eliminates the need for pilots to change frequencies to turn the lights on and allows a continuous listening watch on a single frequency. The CTAF is published on the instrument approach chart and in other appropriate aeronautical information publications. For further details concerning radio controlled lights, see AC 150/5340.27.

159. DESIGNATED UNICOM/MULTICOM FREQUENCIES

a. Communications Between Aircraft.

CAUTION—The Federal Communications Commission (FCC) requires an aircraft station license to operate on UNICOM/MULTICOM frequencies and usage must be in accordance with Part 87 of the FCC Rules (See Section 87.29 regarding license applications). Misuse of these frequencies may result in either the imposition of fines and/or revocation/suspension of FCC aircraft station license.

b. Frequency Use.

The following listing depicts UNICOM and MULTI-

COM frequency uses as designated by the Federal Communications Commission (FCC).

FREQUENCY	USE
122.700	Airports without an operating control tower
122.725	Airports without an operating control tower
122.800	Airports without an operating control tower
123.000	Airports without an operating control tower
122.975	Airports without an operating control tower
122.900	(MULTICOM frequency) Airports with no tower, FSS, or UNICOM
122.950	Airports with a control tower
122.725	Private airports (not open to public)
122.975	High altitude
123.050	Heliports
123.075	Heliports

NOTE— In some areas of the country, frequency interference may be encountered from nearby airports using the same UNICOM frequency. Where this is a problem, UNICOM operators are encouraged to develop a *least interference* frequency assignment plan for airports concerned using the five frequencies designated for airports without operating control towers. UNICOM licensees may then request FCC to assign frequencies in accordance with the plan, which they will review and consider for approval.

160. USE OF UNICOM FOR ATC PURPOSES

UNICOM service may be used for air traffic control purposes, only under the following circumstances:

(1) Revision to proposed departure time.

(2) Takeoff, arrival, or flight plan cancellation time.

(3) ATC clearance, provided arrangements are made between the ATC facility and the UNICOM licensee to handle such messages.

161. AUTOMATIC TERMINAL INFORMATION SERVICE (ATIS)

a. ATIS is the continuous broadcast of recorded noncontrol information in selected high activity terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information. Pilots are urged to cooperate in the ATIS program as it relieves frequency congestion on approach control, ground control, and local control frequencies. The Airport Facility/Directory indicates airports for which ATIS is provided.

b. ATIS information includes the time of the latest weather sequence, ceiling, visibility (if the weather is above a ceiling/sky condition of 5,000 feet and the visibility is 5 miles or more, inclusion of the ceiling/sky condition, visibility, and obstructions to vision in the ATIS message is optional), obstructions to visibility, temperature, dew point (if available), wind direction (magnetic) and velocity, altimeter, other pertinent remarks, instrument approach and runways in use is continuously broadcast on the voice feature of a TVOR/VOR/VORTAC located on or near the airport, or in a discrete VHF/UHF frequency. The departure runway will only be given if different from the landing runway except at locations having a separate ATIS for departure. Where VFR arrival aircraft are expected to make initial contact with approach control, this fact and the appropriate frequencies may be broadcast on ATIS. Pilots of aircraft arriving or departing the terminal area can receive the continuous ATIS broadcasts at times when cockpit duties are least pressing and listen to as many repeats as desired. ATIS broadcasts shall be updated upon the receipt of any official weather, regardless of content change and reported values. A new recording will also be made when there is a change in other pertinent data such as runway change, instrument approach in use, etc.

EXAMPLE:

DULLES INTERNATIONAL INFORMATION SIERRA. 1300 ZULU WEATHER. MEASURED CEILING THREE THOUSAND OVERCAST. VISIBILITY THREE, SMOKE. TEMPERATURE SIX EIGHT. WIND THREE FIVE ZERO AT EIGHT. ALTIMETER TWO NINER NINER TWO. ILS RUNWAY ONE RIGHT APPROACH IN USE. LANDING RUNWAY ONE RIGHT AND LEFT. DEPARTURE RUNWAY THREE ZERO. ARMEL VORTAC OUT OF SERVICE. ADVISE YOU HAVE SIERRA.

c. Pilots should listen to ATIS broadcasts whenever ATIS is in operation.

d. Pilots should notify controllers on initial contact that they have received the ATIS broadcast by repeating the alphabetical code word appended to the broadcast.

EXAMPLE:

"INFORMATION SIERRA RECEIVED."

e. When the pilot acknowledges that he has received the ATIS broadcast, controllers may omit those items contained in the broadcast if they are current. Rapidly changing conditions will be issued by ATC and the ATIS will contain words as follows:

EXAMPLE:

"LATEST CEILING/VISIBILITY/ALTIMETER/WIND/(other conditions) WILL BE ISSUED BY APPROACH CONTROL/TOWER."

NOTE.— The absence of a sky condition or ceiling and/or visibility on ATIS indicates a sky condition or ceiling of 5,000 feet or above and visibility of 5 miles or more. A remark may be made on the broadcast, "The weather is better than 5000 and 5," or the existing weather may be broadcast.

f. Controllers will issue pertinent information to pilots who do not acknowledge receipt of a broadcast or who acknowledge receipt of a broadcast which is not current.

g. To serve frequency limited aircraft, FSSs are equipped to transmit on the omnirange frequency at most en route VORs used as ATIS voice outlets. Such communication interrupts the ATIS broadcast. Pilots of aircraft equipped to receive on other FSS frequencies are encouraged to do so in order that these override transmissions may be kept to an absolute minimum.

h. While it is a good operating practice for pilots to make use of the ATIS broadcast where it is available, some pilots use the phrase "Have Numbers" in communications with the control tower. Use of this phrase means that the pilot has received wind, runway, and altimeter information ONLY and the tower does not have to repeat this informa-

tion. It does not indicate receipt of the ATIS broadcast and should never be used for this purpose.

162. RADAR TRAFFIC INFORMATION SERVICE

This is a service provided by radar ATC facilities. Pilots receiving this service are advised of any radar target observed on the radar display which may be in such proximity to the position of their aircraft or its intended route of flight that it warrants their attention. This service is not intended to relieve the pilot of his responsibility for continual vigilance to see and avoid other aircraft.

a. Purpose of the Service:

(1) The issuance of traffic information as observed on a radar display is based on the principle of assisting and advising a pilot that a particular radar target's position and track indicates it may intersect or pass in such proximity to his intended flight path that it warrants his attention. This is to alert the pilot to the traffic so that he can be on the lookout for it and thereby be in a better position to take appropriate action should the need arise.

(2) Pilots are reminded that the surveillance radar used by ATC does not provide altitude information unless the aircraft is equipped with MODE C and the Radar Facility is capable of displaying altitude information.

b. Provisions of the Service:

(1) Many factors, such as limitations of the radar, volume of traffic, controller workload and communications frequency congestion, could prevent the controller from providing this service. The controller possesses complete discretion for determining whether he is able to provide or continue to provide this service in a specific case. His reason against providing or continuing to provide the service in a particular case is not subject to question nor need it be communicated to the pilot. In other words, the provision of this service is entirely dependent upon whether the controller believes he is in a position to provide it. Traffic information is routinely provided to all aircraft operating on IFR Flight Plans except when the pilot advises he does not desire the service, or the pilot is operating within positive controlled airspace. Traffic information may be provided to flights not operating on IFR Flight Plans when requested by pilots of such flights.

NOTE.— Radar ATC facilities normally display and monitor both primary and secondary radar when it is available, except that secondary radar may be used as the sole display source in Positive Control Airspace (PCA), and under some circumstances outside of PCA (beyond primary coverage and in en route areas where only secondary is available). Secondary radar may also be used outside PCA as the sole display source when the primary radar is temporarily unusable or out of service. Pilots in contact with the affected ATC facility are normally advised when a temporary outage occurs; i.e., "primary radar out of service; traffic advisories available on transponder aircraft only." This means simply that only the aircraft which have transponders installed and in use will be depicted on ATC radar indicators when the primary radar is temporarily out of service.

(2) When receiving VFR radar advisory service, pilots should monitor the assigned frequency at all times. This is to preclude controllers' concern for radio failure or emergency assistance to aircraft under his jurisdiction. VFR radar advisory service does not include vectors away from conflicting traffic unless requested by the pilot. When advisory service is no longer desired, advise the controller before changing frequencies and then change your transponder code to 1200, if applicable. Pilots should also inform the controller when changing VFR cruising altitude. Except in programs where radar service is automatically terminated, the controller will advise the aircraft when radar is terminated.

NOTE.— Participation by VFR pilots in formal programs implemented at certain terminal locations constitutes pilot request. This also applies to participating pilots at those locations when arriving VFR flights are encouraged to make their first contact with the tower on the approach control frequency.

c. Issuance of Traffic Information — Traffic information will include the following concerning a target which may constitute traffic for an aircraft that is:

(1) Radar identified:

(a) Azimuth from the aircraft in terms of the 12 hour clock, or

(b) When rapidly maneuvering civil test or military aircraft prevent accurate issuance of traffic as in (a) above, specify the direction from an aircraft's position in terms of the eight cardinal compass points (N,NE,E,SE,S,SW,W,NW). This method shall be terminated at the pilot's request.

(c) Distance from the aircraft in nautical miles;

(d) Direction in which the target is proceeding; and

(e) Type of aircraft and altitude if known.

EXAMPLE:

Traffic 10 o'clock, 3 miles, west-bound (type aircraft and altitude, if known, of the observed traffic). The altitude may be known, by means of MODE C, but not verified with the pilot for accuracy. (To be valid for separation purposes by ATC, the accuracy of MODE C readouts must be verified. This is usually accomplished upon initial entry into the radar system by a comparison of the readout to pilot stated altitude, or the field elevation in the case of continuous readout being received from an aircraft on the airport.) When necessary to issue traffic advisories containing unverified altitude information, the controller will issue the advisory in the same manner as if it were verified due to the accuracy of these readouts. The pilot may upon receipt of traffic information, request a vector (heading) to avoid such traffic. The vector will be provided to the extent possible as determined by the controller provided the aircraft to be vectored is within the airspace under the jurisdiction of the controller.

(2) Not radar identified:

(a) Distance and direction with respect to a fix;

(b) Direction in which the target is proceeding; and

(c) Type of aircraft and altitude if known.

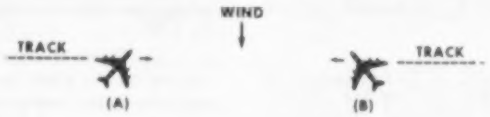
EXAMPLE:

Traffic 8 miles south of the airport northeastbound. (type aircraft and altitude if known).

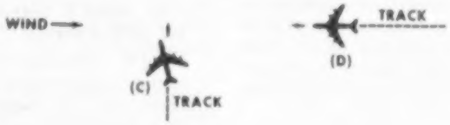
d. The examples depicted in the following figures point out the possible error in the position of this traffic when it is necessary for a pilot to apply drift correction to maintain this track. This error could also occur in the event a change in course is made at the time radar traffic information is issued.

(1) In this figure traffic information would be issued to the pilot of aircraft "A" as 12 o'clock. The actual posi-

tion of the traffic as seen by the pilot of aircraft "A" would be 2 o'clock. Traffic information issued to aircraft "B" would also be given as 12 o'clock, but in this case, the pilot of "B" would see his traffic at 10 o'clock.



(2) In this figure traffic information would be issued to the pilot of aircraft "C" as 2 o'clock. The actual position of the traffic as seen by the pilot of aircraft "C" would be 3 o'clock. Traffic information issued to aircraft "D" would be at an 11 o'clock position. Since it is not necessary for the pilot of aircraft "D" to apply wind correction (crab) to make good his track, the actual position of the traffic issued would be correct. Since the radar controller can only observe aircraft track (course) on his radar display, he must issue traffic advisories accordingly, and pilots should give due consideration to this fact when looking for reported traffic.



163. SAFETY ALERT

A safety alert will be issued to pilots of aircraft being controlled by ATC if the controller is aware the aircraft is at an altitude which, in the controller's judgment, places the aircraft in unsafe proximity to terrain, obstructions or other aircraft. The provision of this service is contingent upon the capability of the controller to have an awareness of a situation involving unsafe proximity to terrain, obstructions and uncontrolled aircraft. The issuance of a safety alert cannot be mandated, but it can be expected on a reasonable, though intermittent basis. Once the alert is issued, it is solely the pilot's prerogative to determine what course of action, if any, he will take. This procedure is intended for use in time critical situations where aircraft safety is in question. Noncritical situations should be handled via the normal traffic alert procedures.

a. Terrain or Obstruction Alert:

(1) The controller will immediately issue an alert to the pilot of an aircraft under his control when he recognizes that the aircraft is at an altitude which, in his judgment, may be in unsafe proximity to terrain/obstructions. The primary method of detecting unsafe proximity is through MODE C automatic altitude reports.

EXAMPLE:

LOW ALTITUDE ALERT, CHECK YOUR ALTITUDE IMMEDIATELY. THE, as appropriate, MEA/MVA/MOCA IN YOUR AREA IS (altitude) or, if past the final approach fix (non precision approach) or the outer marker or fix used in lieu of the outer marker (precision approach), THE, as appropriate, MDA/DH (if known) is (altitude).

(2) Terminal ARTS IIA, III, AND IIIA facilities have an automated function which, if operating, alerts the controller when a tracked MODE C equipped aircraft under his control is below or is predicted to be below a predetermined minimum safe altitude. This function, called Minimum Safe Altitude Warning (MSAW), is designed solely as a controller aid in detecting potentially unsafe aircraft proximity to terrain/ obstructions. The ARTS IIA, III, and IIIA facility will, when MSAW is operating, provide MSAW monitoring for all aircraft with an operating MODE C altitude encoding transponder that are tracked by the system and are:

(a) Operating on an IFR flight plan, or

(b) Operating VFR and have requested MSAW monitoring.

(3) Terminal AN/TPX-42A (number beacon decoder system) facilities have an automated function called Low Altitude Alert System (LAAS). Although not as sophisticated as MSAW, LAAS alerts the controller when a MODE C transponder equipped aircraft operating on an IFR flight plan is below a predetermined minimum safe altitude.

NOTE.— Pilots operating VFR may request MSAW or LAAS monitoring if their aircraft are equipped with MODE C transponders.

EXAMPLE:

APACHE THREE THREE PAPA REQUEST MSAW/LAAS.

b. Aircraft Conflict Alert:

(1) The controller will immediately issue an alert to the pilot of an aircraft under his control if he is aware of another aircraft which is not under his control is at an altitude which, in the controller's judgment, places both aircraft in unsafe proximity to each other. With the alert, when feasible, the controller will offer the pilot the position of the traffic if time permits and an alternate course(s) of action. Any alternate course(s) of action the controller may recommend to the pilot will be predicated only on other traffic under his control.

EXAMPLE:

> AMERICAN THREE, TRAFFIC ALERT, (position of traffic, if time permits), ADVISE YOU TURN RIGHT/LEFT HEADING (degrees) AND/OR CLIMB/DESCEND TO (altitude) IMMEDIATELY.

164. RADAR ASSISTANCE TO VFR AIRCRAFT

a. Radar equipped FAA ATC facilities provide radar assistance and navigation service (vectors) to VFR aircraft provided the aircraft can communicate with the facility, are within radar coverage, and can be radar identified.

b. Pilots should clearly understand that authorization to proceed in accordance with such radar navigational assistance does not constitute authorization for the pilot to violate FARs. In effect, assistance provided is on the basis that navigational guidance information issued is advisory in nature and the job of flying the aircraft safely, remains with the pilot.

c. In many cases, the controller will be unable to determine if flight into instrument conditions will result from his instructions. To avoid possible hazards resulting from being vectored into IFR conditions, pilots should keep the controller advised of the weather conditions in which he is operating and along the course ahead.

d. Radar navigation assistance (vectors) may be initiated by the controller when one of the following conditions exist:

(1) The controller suggests the vector and the pilot concurs.

(2) A special program has been established and vectoring service has been advertised.

(3) In the controller's judgment the vector is necessary for air safety.

e. Radar navigation assistance (vectors) and other radar derived information may be provided in response to pilot requests. Many factors, such as limitations of radar, volume of traffic, communications frequency, congestion, and controller workload could prevent the controller from providing it. The controller has complete discretion for determining if he is able to provide the service in a particular case. His decision not to provide the service in a particular case is not subject to question.

165. TERMINAL RADAR PROGRAMS FOR VFR AIRCRAFT

a. Basic Radar Service

(1) In addition to the use of radar for the control of IFR aircraft, all commissioned radar facilities provide traffic advisories and limited vectoring (on a workload permitting basis) to VFR aircraft.

NOTE.— When the STAGE services were developed, two basic radar services (traffic advisories and limited vectoring) were identified as STAGE I. This definition became, over the years, unnecessary. Therefore, the term STAGE I has been eliminated from use in the field and the handbooks. These basic services will still be provided by all commissioned terminal radar facilities whether they are STAGE II, III, or neither.

(2) Vectoring service may be provided when requested by the pilot or with pilot concurrence when suggested by ATC.

(3) Pilots of arriving aircraft should contact approach control on the publicized frequency and give their position, altitude, radar beacon code (if transponder equipped), destination, and request traffic information.

(4) Approach control will issue wind and runway, except when the pilot states "HAVE NUMBERS" or this information is contained in the ATIS broadcast and the pilot indicates he has received the ATIS information. Traffic information is provided on a workload permitting basis. Approach control will specify the time or place at which the pilot is to contact the tower on local control frequency for further landing information. Upon being told to contact the tower, radar service is automatically terminated.

b. Stage II Service (Radar Advisory and Sequencing for VFR Aircraft)

(1) This service has been implemented at certain terminal locations (See locations listed in the Airport/Facility Directory). The purpose of the service is to adjust the flow of arriving VFR and IFR aircraft into the traffic pattern in a safe and orderly manner and to provide radar traffic information to departing VFR aircraft. Pilot participation is urged but it is not mandatory.

(2) Pilots of arriving VFR aircraft should initiate radio contact on the publicized frequency with approach control when approximately 25 miles from the airport at which Stage II services are being provided. On initial contact by VFR aircraft, approach control will assume that Stage II service is requested. Approach control will provide the pilot with wind and runway (except when the pilot states "HAVE NUMBERS" or that he has received the ATIS information), routings, etc., as necessary for proper sequencing with other participating VFR and IFR traffic en route to the airport. Traffic information will be provided on a workload permitting basis. If an arriving aircraft does not want the service, the pilot should state "NEGATIVE STAGE II" or make a similar comment, on initial contact with approach control.

(3) After radar contact is established, the pilot may navigate on his own into the traffic pattern or, depending on traffic conditions, may be directed to fly specific headings to position the flight behind a preceding aircraft in the approach sequence. When a flight is positioned behind the preceding aircraft and the pilot reports having that aircraft in sight, he will be directed to follow it. If other "nonparticipating" or "local" aircraft are in the traffic pattern, the tower will issue a landing sequence. Radar service will be continued to the runway.

(4) Standard radar separation will be provided between IFR aircraft until such time as the aircraft is sequenced and the pilot sees the traffic he is to follow. Standard radar separation between VFR or between VFR and IFR aircraft will not be provided.

(5) Pilots of departing VFR aircraft are encouraged to request radar traffic information by notifying ground control on initial contact with their request and proposed direction of flight.

EXAMPLE:

XRAY GROUND CONTROL, NOVEMBER ONE EIGHT SIX, READY TO TAXI, VFR SOUTHBOUND, HAVE INFORMATION BRAVO AND REQUEST RADAR TRAFFIC INFORMATION.

NOTE.– Following takeoff, the tower will advise when to contact departure control.

(6) Pilots of aircraft transiting the area and in radar contact/communication with approach control will receive traffic information on a controller workload permitting basis. Pilots of such aircraft should give their position, altitude, radar beacon code (if transponder equipped), destination, and/or route of flight.

c. Stage III Service (Radar Sequencing and Separation Service for VFR Aircraft).

(1) This service has been implemented at certain terminal locations. The service is advertised in the Airport/Facility Directory. The purpose of this service is to provide separation between all participating VFR aircraft and all IFR aircraft operating within the airspace defined as the Terminal Radar Service Area (TRSA). Pilot participation is urged but it is not mandatory.

(2) If any aircraft does not want the service, the pilot should state "NEGATIVE STAGE III" or make a similar comment, on initial contact with approach control or ground control, as appropriate.

(3) TRSAs are depicted on sectional aeronautical charts. A complete list of TRSA locations is contained in PARA. 166.

(4) While operating within a TRSA, pilots are provided Stage III service and separation as prescribed in this paragraph. In the event of a radar outage, separation and sequencing of VFR aircraft will be suspended as this service is dependent on radar. The pilot will be advised that the service is not available and issued wind, runway information, and the time or place to contact the tower. Traffic information will be provided on a workload permitting basis.

(5) Visual separation is used when prevailing conditions permit and it will be applied as follows:

(a) When a VFR flight is positioned behind the preceding aircraft and the pilot reports having that aircraft in sight, he will be directed to follow it. Radar service will be continued to the runway.

(b) When IFR flights are being sequenced with other traffic and the pilot reports the aircraft he is to follow in sight, the pilot may be directed to follow it and will be cleared for a "visual approach."

(c) If other "nonparticipating" or "local" aircraft are in the traffic pattern, the tower will issue a landing sequence.

(d) Departing VFR aircraft may be asked if they can visually follow a preceding departure out of the TRSA. If the pilot concurs, he will be directed to follow it until leaving the TRSA.

(6) Until visual separation is obtained, standard vertical or radar separation will be provided.

(a) 1000 feet vertical separation may be used between IFR aircraft.

(b) 500 feet vertical separation may be used between VFR aircraft, or between a VFR and an IFR aircraft.

(c) Radar separation varies depending on size of aircraft and aircraft distance from the radar antenna. The minimum separation used will be 1 1/2 miles for most VFR aircraft under 12,500 pounds GWT. If being separated from larger aircraft, the minimum is increased appropriately.

(7) Pilots operating VFR under Stage III in a TRSA—

(a) Must maintain an altitude when assigned by ATC unless the altitude assignment is to maintain at or below a specified altitude. ATC may assign altitudes for separation that do not conform to FAR—91.109. When the altitude assignment is no longer needed for separation or when leaving the TRSA, the instruction will be broadcast, "RESUME APPROPRIATE VFR ALTITUDES." Pilots must then return to an altitude that conforms to FAR—91.109 as soon as practicable.

(b) When not assigned an altitude, the pilot should coordinate with ATC prior to any altitude change.

(8) Within the TRSA, traffic information on observed but unidentified targets will, to the extent possible, be provided all IFR and participating VFR aircraft. At the request of the pilot, he will be vectored to avoid the observed traffic, insofar as possible, provided the aircraft to be vectored is within the airspace under the jurisdiction of the controller.

(9) Departing aircraft should inform ATC of their intended destination and/or route of flight and proposed cruising altitude.

(10) ATC will normally advise participating VFR aircraft when leaving the geographical limits of the TRSA. Radar service is not automatically terminated with this advisory unless specifically stated by the controller.

d. **PILOT RESPONSIBILITY:** THESE PROGRAMS ARE NOT TO BE INTERPRETED AS RELIEVING PILOTS OF THEIR RESPONSIBILITIES TO SEE AND AVOID OTHER TRAFFIC OPERATING IN BASIC VFR WEATHER CONDITIONS, TO ADJUST THEIR OPERATIONS AND FLIGHT PATH AS NECESSARY TO PRECLUDE SERIOUS WAKE ENCOUNTERS, TO MAINTAIN APPROPRIATE TERRAIN AND OBSTRUCTION CLEARANCE, OR TO REMAIN IN WEATHER CONDITIONS EQUAL TO OR BETTER THAN THE MINIMUMS REQUIRED BY FAR—91.105. WHENEVER COMPLIANCE WITH AN ASSIGNED ROUTE, HEADING AND/OR ALTITUDE IS LIKELY TO COMPROMISE PILOT RESPONSIBILITY RESPECTING TERRAIN AND OBSTRUCTION CLEARANCE, VORTEX EXPOSURE, AND WEATHER MINIMUMS, APPROACH CONTROL SHOULD BE SO ADVISED AND A REVISED CLEARANCE OR INSTRUCTION OBTAINED.

166. TERMINAL RADAR SERVICE AREAS (TRSAs)

STATE	CITY
ALABAMA	Huntsville, Mobile, Montgomery
ARIZONA	Phoenix, Tucson
ARKANSAS	Ft. Smith
CALIFORNIA	Monterey, Oakland, Palm Springs, San Diego, Santa Ana
COLORADO	Colorado Springs
FLORIDA	Tallahassee
GEORGIA	Augusta, Macon, Savannah
HAWAII	Kahului
IDAHO	Boise
ILLINOIS	Champaign, Moline, Peoria, Rockford, Springfield
INDIANA	Evansville, Ft. Wayne, Indianapolis
IOWA	Cedar Rapids
KANSAS	Wichita
KENTUCKY	Cincinnati (Covington), Lexington, Louisville
LOUISIANA	Baton Rouge, Lafayette, Lake Charles, Monroe, Shreveport
MAINE	Bangor, Portland
MICHIGAN	Flint, Grand Rapids, Kalamazoo, Lansing, Muskegon, Saginaw
MINNESOTA	Rochester
MISSISSIPPI	Columbus AFB, Gulfport, Jackson
MONTANA	Billings, Great Falls
NEBRASKA	Lincoln
NEVADA	Reno
NEW JERSEY	Atlantic City
NEW MEXICO	Albuquerque
NEW YORK	Binghamton, Elmira, Rochester, Rome
NORTH CAROLINA	Asheville, Fayetteville Raleigh-Durham, Wilmington
NORTH DAKOTA	Fargo
OHIO	Akron-Canton, Toledo, Youngstown
OKLAHOMA	Altus
PENNSYLVANIA	Allentown, Erie, Harrisburg, Wilkes-Barre
PUERTO RICO	San Juan
RHODE ISLAND	Providence
SOUTH CAROLINA	Charleston, Columbia, Greer, Shaw AFB (Sumter)
SOUTH DAKOTA	Sioux Falls
TENNESSEE	Bristol, Chattanooga, Knoxville
TEXAS	Amarillo, Abilene, Beaumont, Del Rio (Laughlin AFB), Longview, Midland
VIRGINIA	Dulles, Roanoke
WASHINGTON	Spokane, Tacoma, NAS Whidbey Island
WEST VIRGINIA	Charleston, Huntington
WISCONSIN	Green Bay, Madison

A number of facilities with charted TRSAs have found it necessary to temporarily suspend or curtail Stage III service. Pilots should consult NOTAMs for the latest information on services available. Pilots should also be aware that some TRSAs underlie or are adjacent to TCAs.

167. TOWER EN ROUTE CONTROL (TEC)

a. TEC is an ATC program to provide a service to aircraft proceeding to and from metropolitan areas. It links designated approach control areas by a network of identified routes made up of the existing airway structure of the National Airspace System. The FAA initiated an expanded TEC program to include as many facilities as possible. The program's intent is to provide an overflow resource in the low altitude system which would enhance ATC services. A few facilities have historically allowed turbojets to proceed between certain city pairs, such as Milwaukee and Chicago, via tower en route and these locations may continue this service. However, the expanded TEC program will be applied, generally, for nonturbojet aircraft operating at and below 10,000 feet. The program is entirely within the approach control airspace of multiple terminal facilities. Essentially, it is for relatively short flights. Participating pilots are encouraged to use TEC for flights of two hours duration or less. If longer flights are planned, extensive coordination may be required within the multiple complex which could result in unanticipated delays.

b. Pilots requesting TEC are subject to the same delay factor at the destination airport as other aircraft in the ATC system. In addition, departure and en route delays may occur depending upon individual facility workload. When a major metropolitan airport is incurring significant delays, pilots in the TEC program may want to consider an alternative airport experiencing no delay.

c. There are no unique requirements upon pilots to use the TEC program. Normal flight plan filing procedures will ensure proper flight plan processing. Pilots should include the acronym "TEC" in the remarks section of the flight plan when requesting tower en route. Pictorial and specific route descriptions are published in the Airport/Facility Directory (A/FD).

d. All approach controls in the system may not operate up to the maximum TEC altitude of 10,000 feet. The highest altitude available between any city pair is identified in the A/FD and may be revised in subsequent editions. Additionally, not all airports within an approach control's area are listed. IFR flight may be planned to any satellite airport in proximity to the major primary airport via the same routing (see A/FD for details).

168—169. RESERVED

170. TRANSPONDER OPERATION

a. GENERAL

(1) Pilots should be aware that proper application of transponder operating procedures will provide both VFR and IFR aircraft with a higher degree of safety in the environment where high-speed closure rates are possible. Transponders substantially increase the capability of radar to see an aircraft and the MODE C feature enables the controller to quickly determine where potential traffic conflicts may exist. Even VFR pilots who are not in contact with ATC will be afforded greater protection from IFR aircraft and VFR aircraft which are receiving traffic advisories. Nevertheless, pilots should never relax their visual scanning vigilance for other aircraft.

(2) Air Traffic Control Radar Beacon System (ATCRBS) is similar to and compatible with military coded radar beacon equipment. Civil MODE A is identical to military MODE 3.

(3) Civil and military transponders should be adjusted to the "on" or normal operating position as late as practicable prior to takeoff and to "off" or "standby" as soon as practicable after completing landing roll unless the change to "standby" has been accomplished previously at the request of ATC. IN ALL CASES, WHETHER VFR OR IFR, THE TRANSPONDER SHOULD BE OPERATING WHILE AIRBORNE UNLESS OTHERWISE REQUESTED BY ATC.

(4) If a pilot on an IFR flight cancels his IFR flight plan prior to reaching his destination, he should adjust his transponder according to VFR operations.

(5) If entering a U.S. domestic control area from outside the U.S., the pilot should advise on first radio contact with a U.S. radar ATC facility that such equipment is available by adding "transponder" to the aircraft identification.

(6) It should be noted by all users of the ATC Transponders that the coverage they can expect is limited to "line of sight." Low altitude or aircraft antenna shielding by the aircraft itself may result in reduced range. Range can be improved by climbing to a higher altitude. It may be possible to minimize antenna shielding by locating the antenna where dead spots are only noticed during abnormal flight attitudes.

b. TRANSPONDER CODE DESIGNATION

(1) For ATC to utilize one or a combination of the 4096 discrete codes FOUR DIGIT CODE DESIGNATION will be used, e.g., code 2100 will be expressed as TWO ONE ZERO ZERO. Due to the operational characteristics of the rapidly expanding automated air traffic control system, THE LAST TWO DIGITS OF THE SELECTED TRANSPONDER CODE SHOULD ALWAYS READ "00" UNLESS SPECIFICALLY REQUESTED BY ATC TO BE OTHERWISE.

c. AUTOMATIC ALTITUDE REPORTING (MODE C)

(1) Some transponders are equipped with a MODE C automatic altitude reporting capability. This system converts aircraft altitude in 100 foot increments to coded digital information which is transmitted together with MODE C framing pulses to the interrogating radar facility. The manner in which transponder panels are designed differs, therefore, a pilot should be thoroughly familiar with the operation of his transponder so that ATC may realize its full capabilities.

(2) Adjust transponder to reply on the MODE A/3 code specified by ATC and, if equipped, to reply on MODE C with altitude reporting *capability activated* unless deactivation is directed by ATC or unless the installed aircraft equipment has not been tested and calibrated as required by FAR—91.36. If deactivation is required by ATC, turn off the altitude reporting feature of your transponder. An instruction by ATC to "STOP ALTITUDE SQUAWK, ALTITUDE DIFFERS (number of feet) FEET," may be an indication that your transponder is transmitting incorrect altitude information or that you have an incorrect altimeter setting. While an incorrect altimeter setting has no effect on the MODE C altitude information transmitted by your transponder (transponders are preset at 29.92), it would cause you to fly at an actual altitude different from your assigned altitude. When a controller indicates that an altitude readout is invalid, the pilot should initiate a check to verify that the aircraft altimeter is set correctly.

(3) Pilots of aircraft with operating MODE C altitude reporting transponders should report exact altitude or flight level to the nearest hundred foot increment when establishing initial contact with an ATC facility. Exact altitude or flight level reports on initial contact provide ATC with information that is required prior to using MODE C altitude information for separation purposes. This will significantly reduce altitude verification requests.

d. TRANSPONDER IDENT FEATURE

(1) The transponder shall be operated only as specified by ATC. Activate the "IDENT" feature only upon request of the ATC controller.

e. CODE CHANGES

(1) When making routine code changes, pilots should avoid inadvertent selection of codes 7500, 7600 or 7700 thereby causing momentary false alarms at automated ground facilities. For example when switching from code 2700 to code 7200, switch first to 2200 then to 7200, NOT to 7700 and then 7200. This procedure applies to nondiscrete code 7500 and all discrete codes in the 7600 and 7700 series (i.e. 7600-7677, 7700-7777) which will trigger special indicators in automated facilities. Only nondiscrete code 7500 will be decoded as the hijack code.

(2) Under no circumstances should a pilot of a civil aircraft operate the transponder on Code 7777. This code is reserved for military interceptor operations.

(3) Military pilots operating VFR or IFR within restricted/warning areas should adjust their transponders to code 4000 unless another code has been assigned by ATC.

f. DEVIATIONS FROM TRANSPONDER REQUIREMENTS

(1) Specific details concerning requirements, exceptions and ATC authorized deviations for transponder and MODE C operation above 12,500 feet and below 18,000 feet MSL are found in FAR—91.24. In general, the FAR requires aircraft to be equipped with MODE A/3 (4096 codes) and MODE C altitude reporting capability when operating in controlled airspace of the 48 contiguous States and the District of Columbia above 12,500 feet MSL, excluding airspace at and below 2,500 feet AGL. Pilots should insure that their aircraft transponder is operating on an appropriate or ATC assigned VFR/IFR code and MODE C when operating in such airspace. If in doubt about the operational status of either feature of your transponder while airborne, contact the nearest ATC facility or FSS and they will advise you what facility you should contact for determining the status of your equipment. In-flight requests for "immediate" deviation may be approved by controllers only when the flight will continue IFR or when weather conditions prevent VFR descent and continued VFR flight in airspace not affected by the FAR. All other requests for deviation should be made by contacting the nearest Flight Service or Air Traffic facility in person or by telephone. The nearest ARTCC will normally be the controlling agency and is responsible for coordinating requests involving deviations in other ARTCC areas.

g. TRANSPONDER OPERATION UNDER VISUAL FLIGHT RULES (VFR)

(1) Unless otherwise instructed by an Air Traffic Control Facility, adjust Transponder to reply on MODE 3/A code 1200 regardless of altitude.

(2) Adjust transponder to reply on MODE C, with altitude reporting *capability activated* if the aircraft is so equipped, unless deactivation is directed by ATC or unless the installed equipment has not been tested and calibrated as required by FAR—91.36. If deactivation is required and your transponder is so designed, turn off the altitude reporting switch and continue to transmit MODE C framing pulses. If this capability does not exist, turn off MODE C.

h. RADAR BEACON PHRASEOLOGY

Air traffic controllers, both civil and military, will use the following phraseology when referring to operation of the Air Traffic Control Radar Beacon System (ATCRBS). Instructions by ATC refer only to MODE A/3 or MODE C operation and do not affect the operation of the transponder on other MODEs.

(1) **SQUAWK (number)** — Operate radar beacon transponder on designated code in MODE A/3.

(2) **IDENT** — Engage the "IDENT" feature (military I/P) of the transponder.

(3) **SQUAWK (number) and IDENT** — Operate transponder on specified code in MODE A/3 and engage the "IDENT" (military I/P) feature.

(4) **SQUAWK STANDBY** — Switch transponder to standby position.

(5) **SQUAWK LOW/NORMAL** — Operate transponder on low or normal sensitivity as specified. Transponder is operated in "NORMAL" position unless ATC specifies "LOW", ("ON" is used instead of "NORMAL" as a master control label on some types of transponders.)

(6) **SQUAWK ALTITUDE** — Activate MODE C with automatic altitude reporting.

(7) **STOP ALTITUDE SQUAWK** — Turn off altitude reporting switch and continue transmitting MODE C framing pulses. If your equipment does not have this capability, turn off MODE C.

(8) **STOP SQUAWK (mode in use)** — Switch off specified mode. (Used for military aircraft when the controller is unaware of military service requirements for the aircraft to continue operation on another MODE.)

(9) **STOP SQUAWK** — Switch off transponder.

(10) **SQUAWK MAYDAY** — Operate transponder in the emergency position (MODE A Code 7700 for civil transponder. MODE 3 Code 7700 and emergency feature for military transponder.)

171. HAZARDOUS AREA REPORTING SERVICE

a. Selected FSSs provide flight monitoring where regularly traveled VFR routes cross large bodies of water, swamps, and mountains. This service is provided for the purpose of expeditiously alerting Search and Rescue facilities when required.

(1) When requesting the service either in person, by telephone or by radio, pilots should be prepared to give the following information — type of aircraft, altitude, indicated airspeed, present position, route of flight, heading.

(2) Radio contacts are desired at least every 10 minutes. If contact is lost for more than 15 minutes, Search and Rescue will be alerted. Pilots are responsible for cancelling their request for service when they are outside the service area boundary. Pilots experiencing two-way radio failure are expected to land as soon as practicable and cancel their request for the service. The accompaning illustration titled "LAKE, ISLAND, MOUNTAIN AND SWAMP REPORTING SERVICE" depicts the areas and the FSS facilities involved in this program.

b. LONG ISLAND SOUND REPORTING SERVICE

The New York and Bridgeport FSSs provide Long Island Sound Reporting service on request for aircraft traversing Long Island Sound.

(1) When requesting the service pilots should ask for SOUND REPORTING SERVICE and should be prepared to provide the following appropriate information:

(a) Type and color of aircraft,

(b) The specific route and altitude across the sound including the shore crossing point,

(c) The overwater crossing time,

(d) Number of persons on board,

(e) True air speed.

(2) Radio contacts are desired at least every 10 minutes, however, for flights of shorter duration a midsound report is requested. If contact is lost for more than 15 minutes Search and Rescue will be alerted. Pilots are responsible for cancelling their request for the Long Island Sound Reporting Service when outside the service area boundary. Aircraft experiencing radio failure will be expected to land as soon as practicable and cancel their request for the service.

(3) COMMUNICATIONS: Primary communications—pilots are to transmit on 122.1 MHz and listen on one of the following VOR frequencies:

(a) NEW YORK FSS CONTROLS:

1. Hampton VORTAC (FSS transmits on 113.6 and receives on 122.1 MHz).

2. Calverton VORTAC (FSS transmits on 117.2 and receives on standard FSS frequencies).

3. Kennedy VORTAC (FSS transmits on 115.9 and receives on 122.1 MHz).

(b) BRIDGEPORT FSS CONTROLS:

1. Madison VORTAC (FSS transmits on 110.4 and receives on 122.1 MHz).

2. Trumbull VOR (FSS transmits on 111.8 and receives on 122.1 MHz).

3. Bridgeport VOR (FSS transmits on 108.8 and receives on 122.1 MHz).

c. BLOCK ISLAND REPORTING SERVICE

Within the Long Island Reporting Service, the New York FSS also provides an additional service for aircraft operating between Montauk Point and Block Island. When requesting this service, pilots should ask for BLOCK ISLAND REPORTING SERVICE and should be prepared to provide the same flight information as required for the Long Island Sound Reporting Service.

(1) A minimum of three position reports are mandatory for this service; these are:

(a) Reporting leaving either Montauk Point or Block Island.

(b) Midway report.

(c) Report when over either Montauk Point or Block Island. At this time, the overwater service is cancelled.

(2) COMMUNICATIONS: Pilots are to transmit on 122.1 MHz and listen on the Hampton VORTAC (HTO) frequency 113.6 MHz.

NOTE.— Pilots are advised that 122.1 MHz is a remote receiver located at the Hampton VORTAC site and designed to provide radio coverage between Hampton and Block Island. Flights proceeding beyond Block Island may contact the Boston FSS on 122.6 MHz (transmit and receive) or by transmitting on 122.1 MHz and listening on Martha's Vineyard VORTAC (MVY) frequency 108.2 MHz.

d. CAPE COD AND ISLANDS RADAR OVERWATER FLIGHT FOLLOWING

In addition to normal VFR radar advisory services, traffic permitting, Otis Approach Control provides a radar overwater flight following service for aircraft traversing the Cape Cod and adjacent Island area. Pilots desiring this service may contact Otis RAPCON on 118.2 MHz.

(1) Pilots requesting this service should be prepared to give the following information:

(a) type and color of aircraft,

(b) altitude,

(c) position and heading,

(d) route of flight, and

(e) true airspeed.

(2) For best radar coverage, pilots are encouraged to fly at 1,500 feet MSL or above.

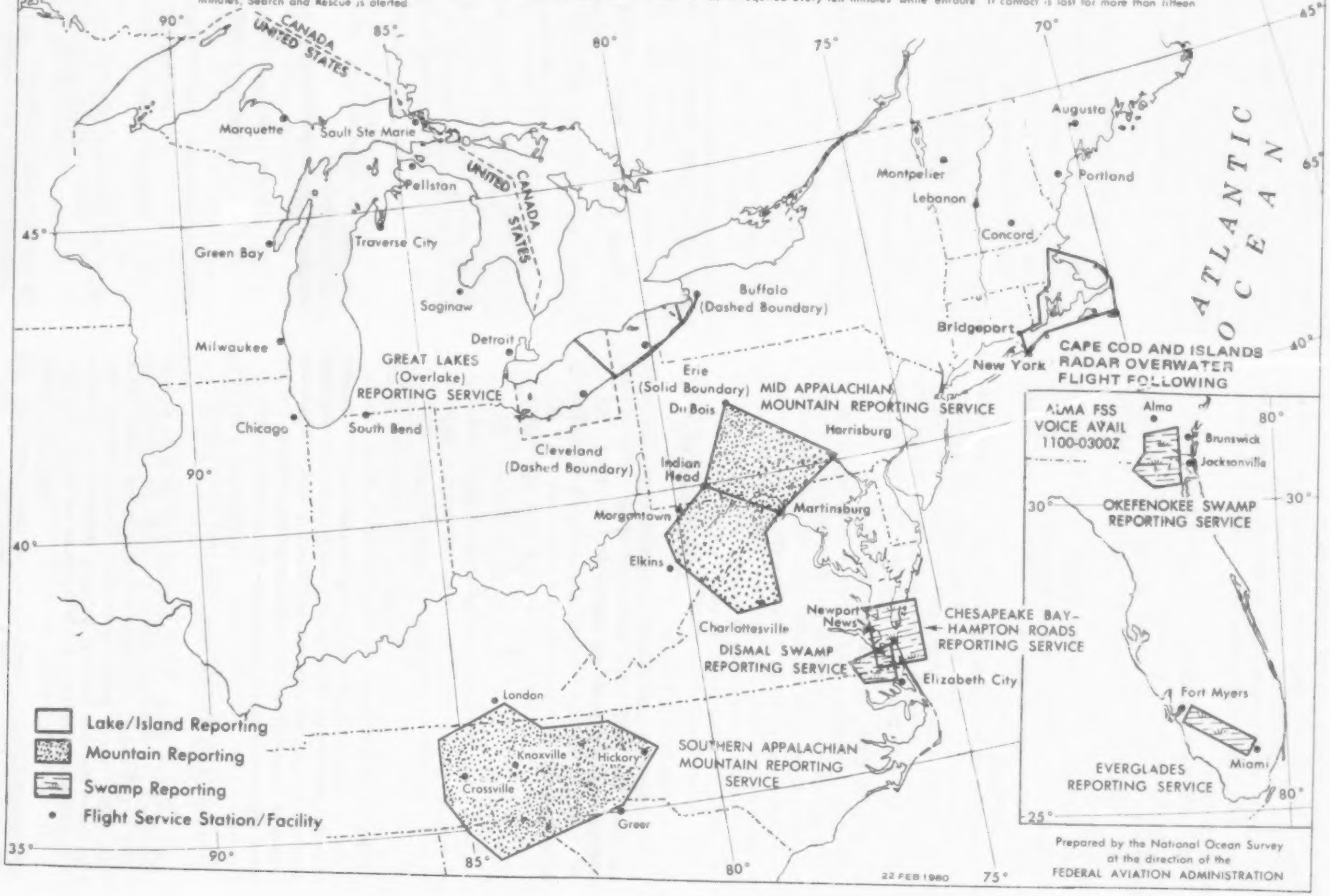
(3) Pilots are responsible for cancelling their request for overwater flight following when they are over the mainland and/or outside the service area boundary.

172—189. RESERVED

LAKE/ISLAND, MOUNTAIN AND SWAMP REPORTING SERVICE

Flight Service Station (FSS)

This service provides flight monitoring where regularly traveled VFR routes cross large bodies of water, swamps, and mountains, for the purpose of expeditiously alerting Search and Rescue facilities when required. Areas covered, associated Flight Service Stations, and the name of the service, "Stoneface", "Overlake" etc., are indicated on the following charts. To obtain this service, contact the FSS by telephone or radio giving present position, type aircraft, altitude, indicated air speed, proposed route of flight, and mainland estimate. After these arrangements have been made, a radio contact with the FSS is required every ten minutes while enroute. If contact is lost for more than fifteen minutes, Search and Rescue is alerted.


90°
85°
80°
75°
70°
45°
65°
40°
35°
CANADA
UNITED STATES
UNITED STATES
CANADA
Marquette
Sault Ste Marie
Pellston
Green Bay
Traverse City
Saginaw
Milwaukee
Detroit
GREAT LAKES (Overlake) REPORTING SERVICE
Chicago
South Bend
Buffalo (Dashed Boundary)
Erie (Solid Boundary)
Du Bois
Cleveland (Dashed Boundary)
Indian Head
Morgantown
Martinsburg
Harrisburg
MID APPALACHIAN MOUNTAIN REPORTING SERVICE
Elkins
Charlottesville
Newport News
CHESAPEAKE BAY-HAMPTON ROADS REPORTING SERVICE
DISMAL SWAMP REPORTING SERVICE
Elizabeth City
London
Knoxville
Hickory
Crossville
Greer
SOUTHERN APPALACHIAN MOUNTAIN REPORTING SERVICE
Montpelier
Lebanon
Concord
Augusta
Portland
Bridgeport
New York
CAPE COD AND ISLANDS RADAR OVERWATER FLIGHT FOLLOWING
ATLANTIC OCEAN
ALMA FSS VOICE AVAIL 1100-0300Z
Alma
Brunswick
Jacksonville
30°
OKEFENOKEE SWAMP REPORTING SERVICE
Fort Myers
Miami
EVERGLADES REPORTING SERVICE
25°
Lake/Island Reporting
Mountain Reporting
Swamp Reporting
Flight Service Station/Facility
22 FEB 1980

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Section 2. RADIO COMMUNICATIONS PHRASEOLOGY AND TECHNIQUES

190. GENERAL

a. Radio communications are a critical link in the ATC system. The link can be a strong bond between pilot and controller or it can be broken with surprising speed and disastrous results. Discussion herein provides basic procedures for new pilots and also highlights safe operating concepts for all pilots.

b. The single, most important thought in pilot-controller communications is understanding. It is essential, therefore, that pilots acknowledge each radio communication with ATC by using the appropriate aircraft call sign. Brevity is important, and contacts should be kept as brief as possible, but the controller must know what you want to do before he can properly carry out his control duties. And you, the pilot, must know exactly what he wants you to do. Since concise phraseology may not always be adequate, use whatever words are necessary to get your message across.

c. All pilots will find the Pilot/Controller Glossary very helpful in learning what certain words or phrases mean. Good phraseology enhances safety and is the mark of a professional pilot. Jargon, chatter and "CB" slang have no place in ATC communications. The Pilot/Controller Glossary is the same glossary used in the ATC controller's handbook. We recommend that it be studied and reviewed from time to time to sharpen your communication skills.

191. RADIO TECHNIQUE

a. *Listen* before you transmit. Many times you can get the information you want through ATIS or by monitoring the frequency. Except for a few situations where some frequency overlap occurs, if you hear someone else talking, the keying of your transmitter will be futile and you will probably jam their receivers causing them to repeat their call. If you have just changed frequencies, pause, listen and make sure the frequency is clear.

b. *Think* before keying your transmitter. Know what you want to say and if it is lengthy, e.g., a flight plan or IFR position report, jot it down.

c. The microphone should be very close to your lips and after pressing the mike button, a slight pause may be necessary to be sure the first word is transmitted. Speak in a normal conversational tone.

d. When you release the button, wait a few seconds before calling again. The controller or FSS specialist may be jotting down your number, looking for your flight plan, transmitting on a different frequency, or selecting his transmitter to your frequency.

e. Be alert to the sounds *or lack of sounds* in your receiver. Check your volume, recheck your frequency and *make sure that your microphone is not stuck* in the transmit position. Frequency blockage can, and has, occurred for extended periods of time due to unintentional transmitter operation. This type of interference is commonly referred to as a "stuck mike," and controllers may refer to it in this manner when attempting to assign an alternate frequency. If the assigned frequency is completely blocked by this type of interference, use the procedures described for en route IFR radio frequency outage, to establish or reestablish communications with ATC.

f. Be sure that you are within the performance range of your radio equipment and the ground station equipment. Remote radio sites do not always transmit and receive on all of a facilities available frequencies, particularly with regard to VOR sites where you can hear but not reach a ground station's receiver. Remember that higher altitude increases the range of VHF "line of sight" communications.

192. CONTACT PROCEDURES

a. Initial Contact.

(1) The term initial contact or initial callup means the first radio call you make to a given facility, or the first call to a different controller or FSS specialist within a facility. *Use the following format:*

(a) name of facility being called,

(b) your *full* aircraft identification as filed in the flight plan or as discussed under Aircraft Call Signs below,

(c) type of message to follow or your request if it is short, and

(d) the word "Over", if required.

EXAMPLE:

"NEW YORK RADIO, MOONEY THREE ONE ONE ECHO."

EXAMPLE:

"COLUMBIA GROUND, CESSNA THREE ONE SIX ZERO FOXTROT, IFR MEMPHIS."

EXAMPLE:

"MIAMI CENTER BARON FIVE SIX THREE HOTEL, REQUEST VFR TRAFFIC ADVISORIES."

(2) If radio reception is reasonably assured, inclusion of your request, your position or altitude, the phrase "Have numbers" or "Information Charlie received" (for ATIS) in the initial contact helps decrease radio frequency congestion. Use discretion and do not overload the controller with information he does not need. If you do not get a response from the ground station, recheck your radios or use another transmitter but keep the next contact short.

EXAMPLE:

"ATLANTA CENTER, DUKE FOUR ONE ROMEO, REQUEST VFR TRAFFIC ADVISORIES, TWENTY NORTHWEST ROME, SEVEN THOUSAND FIVE HUNDRED, OVER."

b. Initial Contact When your Transmitting and Receiving Frequencies are Different.

(1) If you are attempting to establish contact with a ground station and you are receiving on a different frequency than that transmitted, indicate the VOR name or the frequency on which you expect a reply. Most FSSs and control facilities can transmit on several VOR stations in the area. Use the appropriate FSS call sign as indicated on charts.

EXAMPLE:

> New York FSS transmits on the Kennedy, Hampton and Calverton VORTACs. If you are in the Calverton area, your callup should be "NEW YORK RADIO, CESSNA THREE ONE SIX ZERO FOXTROT, RECEIVING CALVERTON VOR, OVER."

(2) If the chart indicates FSS frequencies above the VORTAC or in FSS communications boxes, transmit or receive on those frequencies nearest your location.

(3) When unable to establish contact and you wish to call *any* ground station, use the phrase "ANY RADIO (tower) (station), GIVE CESSNA THREE ONE SIX ZERO FOXTROT A CALL ON (frequency) OR (VOR)." If an emergency exists or you need assistance, so state.

c. Subsequent Contacts and Responses to Callup from a Ground Facility.

Use the same format as used for initial contact except you should state your message or request with the callup in one transmission. The ground station name and the word "Over" may be omitted if the message requires an obvious reply and there is no possibility for misunderstandings. *You should acknowledge all callups or clearances* unless the controller or FSS specialist advises otherwise. There are some occasions when the controller must issue time-critical instructions to other aircraft and he may be in a position to observe your response, either visually or on radar. If the situation demands your response, take appropriate action or immediately advise the facility of any problem. Acknowledgement is made with one of the words "Wilco, Roger, Affirmative, Negative" or other appropriate remarks (e.g., "PIPER TWO ONE FOUR LIMA, ROGER"). If you have been receiving services (e.g., VFR traffic advisories and you are leaving the area or changing frequencies), advise the ATC facility and terminate contact.

d. Acknowledgement of Frequency Changes.

(1) When advised by ATC to change frequencies, acknowledge the instruction. If you select the new frequency without an acknowledgement, the controller's workload is increased because he has no way of knowing whether you received the instruction or have had radio communications failure.

(2) At times, a controller/specialist may be working a sector with multiple frequency assignments. In order to eliminate unnecessary verbiage and to free the controller/specialist for higher priority transmissions, the controller/specialist may request the pilot "(Identification), change to my frequency 123.4." This phrase should alert the pilot that he is only changing frequencies, not controller/specialist, and that initial call up phraseology may be abbreviated.

EXAMPLE:

> "UNITED 222 ON 123.4."

e. Compliance with Frequency Changes.

When instructed by ATC to change frequencies, select the new frequency as soon as possible unless instructed to make the change at a specific time, fix, or altitude. A delay in making the change could result in an untimely receipt of important information. If you are instructed to make the frequency change at a specific time, fix, or altitude, monitor the frequency you are on until reaching the specified time, fix, or altitudes unless instructed otherwise by ATC. (See PARA—340 - ARTCC COMMUNICATIONS.)

193. AIRCRAFT CALL SIGNS

a. Precautions in the Use of Call Signs.

(1) Improper use of call signs can result in pilots executing a clearance intended for another aircraft. Call signs should *never be abbreviated on an initial contact or at any time when other aircraft call signs have similar numbers/sounds or identical letters/number* (e.g., Cessna 6132F, Cessna 1622F, Baron 123F, Cherokee 7732F, etc.).

EXAMPLE:

> Assume that a controller issues an approach clearance to an aircraft at the bottom of a holding stack and an aircraft with a similar call sign (at the top of the stack) acknowledges the clearance with the last two or three numbers of his call sign. If the aircraft at the bottom of the stack did not hear the clearance and intervene, flight safety would be affected, and there would be no reason for either the controller or pilot to suspect that anything is wrong. This kind of "human factors" error can strike swiftly and is extremely difficult to rectify.

(2) Pilots; therefore, must be certain that aircraft identification is complete and clearly identified before taking action on an ATC clearance. ATC specialists will not abbreviate call signs of air carrier or other civil aircraft having authorized call signs. ATC specialists may initiate abbreviated call signs of other aircraft by using the *prefix and the last three digits/letters* of the aircraft identification after communications are established. The pilot may use the abbreviated call sign in subsequent contacts with the ATC specialist. When aware of similar/identical call signs, ATC specialists will take action to minimize errors by emphasizing certain numbers/letters, by repeating the entire call sign, repeating the prefix, or by asking pilots to use a different call sign temporarily. Pilots should use the phrase "VERIFY CLEARANCE FOR (your complete call sign)" if doubt exists concerning proper identity.

(3) Civil aircraft pilots should state the aircraft type, model or manufacturer's name followed by the digits/letters of the registration number. When the aircraft manufacturer's name or model is stated, the prefix "N" is dropped (e.g. Aztec Two Four Six Four Alpha).

EXAMPLE:

> BONANZA SIX FIVE FIVE GOLF.

EXAMPLE:

> BREEZY SIX ONE THREE ROMEO EXPERIMENTAL (omit "Experimental" after initial contact).

(4) Air Taxi or other commercial operators *not* having FAA authorized call signs should prefix their normal identification with the phonetic word "Tango".

EXAMPLE:

> TANGO AZTEC TWO FOUR SIX FOUR ALPHA.

(5) Air carriers and commuter air carriers having FAA authorized call signs should identify themselves by stating the complete call sign, using group form for the numbers and the word "heavy" if appropriate.

EXAMPLE:

> UNITED TWENTY-FIVE HEAVY.

EXAMPLE:

MIDWEST COMMUTER SEVEN ELEVEN.

(6) Military aircraft use a variety of systems including serial numbers, word call signs and combinations of letters/numbers. Examples include Army Copter 48931, Air Force 61782, MAC 31792, Pat 157, Air Evac 17652, Navy Golf Alfa Kilo 21, Marine 4 Charlie 36, etc.

b. Air Ambulance Flights.

(1) Civilian air ambulance flights responding to medical emergencies (carrying patients, organ donors, organs, or other urgently needed lifesaving medical material) will be expedited by ATC when necessary. When expeditious handling is required, add the word "LIFEGUARD" in the remarks of the flight plan. In radio communication, use the call sign "LIFEGUARD" followed by the aircraft type and registration letters/numbers. When requested by the pilot, necessary notification to expedite ground handling of patients, etc., is provided by ATC; however, when possible, this information should be passed in advance through non-ATC communications systems. Extreme discretion is necessary in using the term "LIFEGUARD." It is intended only for those missions of an urgent medical nature and for use only for that portion of the flight requiring expedited handling.

(2) Similar provisions have been made for the use of "AIR EVAC" and "MED EVAC" by military air ambulance flights, except that these military flights will receive priority handling only when specifically requested.

EXAMPLE:

LIFEGUARD CESSNA TWO SIX FOUR SIX.

c. Student Pilots Radio Identification.

(1) The FAA desires to help the student pilot in acquiring sufficient practical experience in the environment in which he will be required to operate. To receive additional assistance while operating in areas of concentrated air traffic, a student pilot need only identify himself as a student pilot during his initial call to an FAA radio facility.

EXAMPLE:

DAYTON TOWER, THIS IS FLEETWING 1234, STUDENT PILOT.

(2) This special identification will alert FAA ATC personnel and enable them to provide the student pilot with such extra assistance and consideration as he may need. This procedure is not mandatory.

194. DESCRIPTION OF INTERCHANGE OR LEASED AIRCRAFT

a. Controllers issue traffic information based on familiarity with airline equipment and color/markings. When an air carrier dispatches a flight using another company's equipment and the pilot does not advise the terminal ATC facility, the possible confusion in aircraft identification can compromise safety.

b. Pilots flying an "interchange" or "leased" aircraft not bearing the colors/markings of the company operating the aircraft should inform the terminal ATC facility on first contact the name of the operating company and trip number, followed by the company name as displayed on the aircraft, and aircraft type.

EXAMPLE:

AIR CAL 311, UNITED (INTERCHANGE/LEASE), BOEING 727.

195. GROUND STATION CALL SIGNS

Pilots, when calling a ground station, should begin with the name of the facility being called followed by the type of the facility being called, as indicated in the following examples.

Airport Unicom	"Shannon Unicom"
FAA Flight Service Station	"Chicago Radio"
FAA Flight Service Station (En Route Flight Advisory Service (Weather)	"Seattle Flight Watch"
Airport Traffic Control Tower	"Augusta Tower"
Clearance Delivery Position (IFR)	"Dallas Clearance Delivery"
Ground Control Position in Tower	"Miami Ground"
Radar or Nonradar Approach Control Position	"Oklahoma City Approach"
Radar Departure Control Position	"St. Louis Departure"
FAA Air Route Traffic Control Center	"Washington Center"

196. PHONETIC ALPHABET

The International Civil Aviation Organization (ICAO) phonetic alphabet is used by FAA personnel when communications conditions are such that the information cannot be readily received without their use. ATC facilities may also request pilots to use phonetic letter equivalents when aircraft with similar sounding identifications are receiving communications on the same frequency. Pilots should use the phonetic alphabet when identifying their aircraft during initial contact with air traffic control facilities. Additionally use the phonetic equivalents for single letters and to spell out groups of letters or difficult words during adverse communications conditions.

CHARACTER	MORSE CODE	TELEPHONY	PHONIC (PRONUNCIATION)
A	○▭	Alfa	(AL-FAH)
B	▭○○○	Bravo	(BRAH-VOH)
C	▭○▭○	Charlie	(CHAR-LEE) or (SHAR-LEE)
D	▭○○	Delta	(DELL-TAH)
E	○	Echo	(ECK-OH)
F	○○▭○	Foxtrot	(FOKS-TROT)
G	▭▭○	Golf	(GOLF)
H	○○○○	Hotel	(HOH-TEL)

CHARACTER	MORSE CODE	TELEPHONY	PHONIC (PRONUNCIATION)
I	○○	India	IN-DEE-AH)
J	○▭▭▭	Juliett	(JEW-LEE-ETT)
K	▭○▭	Kilo	(KEY-LOH)
L	○▭○○	Lima	(LEE-MAH)
M	▭▭	Mike	(MIKE)
N	▭○	November	(NO-VEM-BER)
O	▭▭▭	Oscar	(OSS-CAH)
P	○▭▭○	Papa	(PAH-PAH)
Q	▭▭○▭	Quebec	(KEH-BECK)
R	○▭○	Romeo	(ROW-ME-OH)
S	○○○	Sierra	(SEE-AIR-RAH)
T	▭	Tango	(TANG-GO)
U	○○▭	Uniform	(YOU-NEE-FORM) or (OO-NEE-FORM)
V	○○○▭	Victor	(VIK-TAH)
W	○▭▭	Whiskey	(WISS-KEY)
X	▭○○▭	Xray	(ECKS-RAY)
Y	▭○▭▭	Yankee	(YANG-KEY)
Z	▭▭○○	Zulu	(ZOO-LOO)
1	○▭▭▭▭	One	(WUN)
2	○○▭▭▭	Two	(TOO)
3	○○○▭▭	Three	(TREE)
4	○○○○▭	Four	(FOW-ER)
5	○○○○○	Five	(FIFE)
6	▭○○○○	Six	(SIX)
7	▭▭○○○	Seven	(SEV-EN)
8	▭▭▭○○	Eight	(AIT)
9	▭▭▭▭○	Nine	(NIN-ER)
0	▭▭▭▭▭	Zero	(ZEE-RO)

197—199. RESERVED

200. FIGURES

a. Figures indicating hundred and thousands in round number, as for ceiling heights, and upper wind levels up to 9900 shall be spoken in accordance with the following:

EXAMPLE:

500..FIVE HUNDRED

EXAMPLE:

4500.................FOUR THOUSAND FIVE HUNDRED

b. Numbers above 9900 shall be spoken by separating the digits preceding the word "thousand."

EXAMPLE:

10,000.....................................ONE ZERO THOUSAND

EXAMPLE:

13,500...ONE THREE THOUSAND FIVE HUNDRED

c. Transmit airway or jet route numbers as follows:

EXAMPLE:

V12... VICTOR TWELVE

EXAMPLE:

J533..J FIVE THIRTY-THREE

d. All other numbers shall be transmitted by pronouncing each digit.

EXAMPLE:

10...ONE ZERO

e. When a radio frequency contains a decimal point, the decimal point is spoken as "POINT."

EXAMPLE:

122.1................................ONE TWO TWO POINT ONE

NOTE.— ICAO Procedures require the decimal point be spoken as "DECIMAL" and FAA will honor such usage by military aircraft and all other aircraft required to use ICAO Procedures.

201. ALTITUDES AND FLIGHT LEVELS

a. Up to but not including 18,000 feet MSL — state the separate digits of the thousands, plus the hundreds, if appropriate.

EXAMPLE:

12,000.. ONE TWO THOUSAND

EXAMPLE:

12,500.......ONE TWO THOUSAND FIVE HUNDRED

b. At and above, 18,000 feet MSL (FL 180) state the words "flight level" followed by the separate digits of the flight level.

EXAMPLE:

190.......................FLIGHT LEVEL ONE NINER ZERO

202. DIRECTIONS

The three digits of bearing, course, heading or wind direction should always be magnetic. The word "true" must be added when it applies.

EXAMPLE:

(magnetic course) 005....................... ZERO ZERO FIVE

EXAMPLE:

(true course) 050.................. ZERO FIVE ZERO TRUE

EXAMPLE:

(magnetic bearing) 360....................THREE SIX ZERO

EXAMPLE:

(magnetic heading) 100....................ONE ZERO ZERO

EXAMPLE:

(wind direction) 220..........................TWO TWO ZERO

203. SPEEDS

The separate digits of the speed followed by the word "KNOTS." Except, controllers may omit the word "KNOTS" when using speed adjustment procedures, e.g., "REDUCE/INCREASE SPEED TO TWO FIVE ZERO."

EXAMPLES:

(speed) 250............................TWO FIVE ZERO KNOTS
(speed) 190........................ONE NINER ZERO KNOTS

The separate digits of the mach number preceded by "MACH."

EXAMPLES:

(mach number) 1.5.............MACH ONE POINT FIVE
(mach number) .64..............MACH POINT SIX FOUR
(mach number) .7......................MACH POINT SEVEN

204. TIME

a. FAA uses Coordinated Universal Time (UTC) for all operations. The term "Zulu" is used when ATC procedures require a reference to UTC.

EXAMPLE:

0920......................................ZERO NINER TWO ZERO

b. To Convert from Standard Time to Coordinated Universal Time:

Eastern Standard Time.............................Add 5 hours
Central Standard Time..............................Add 6 hours
Mountain Standard Time...........................Add 7 hours
Pacific Standard Time..... ....Add 8 hours

NOTE.— For Daylight Time subtract 1 hour.

c. The 24-hour clock system is used in radiotelephone transmissions. The hour is indicated by the first two figures and the minutes by the last two figures.

EXAMPLE:

0000..ZERO ZERO ZERO ZERO

EXAMPLE:

0920......................................ZERO NINER TWO ZERO

d. Time may be stated in minutes only (two figures) in radio telephone communications when no misunderstanding is likely to occur.

e. Current time in use at a station is stated in the nearest quarter minute in order that pilots may use this information for time checks. Fractions of a quarter minute less than eight seconds are stated as the preceding quarter minute; fractions of a quarter minute of eight seconds or more are stated as the succeeding quarter minute.

EXAMPLE:

0929:05..................TIME, ZERO NINER TWO NINER

EXAMPLE:

0929:10...TIME, ZERO NINER TWO NINER AND ONE-QUARTER

205. COMMUNICATIONS WITH TOWER WHEN AIRCRAFT TRANSMITTER OR RECEIVER OR BOTH ARE INOPERATIVE

a. Arriving Aircraft

(1) Receiver inoperative — If you have reason to believe your receiver is inoperative, remain outside or above the airport traffic area until the direction and flow of traffic has been determined, then advise the tower of your type aircraft, position, altitude, intention to land and request that you be controlled with light signals. (See PARA—233 - TRAFFIC CONTROL OF LIGHT SIGNALS.) When you are approximately 3 to 5 miles from the airport, advise the tower of your position and join the airport traffic pattern. From this point on, watch the tower for light signals. Thereafter, if a complete pattern is made, transmit your position downwind and/or turning base leg.

(2) Transmitter inoperative — Remain outside or above the airport traffic area until the direction and flow of traffic has been determined, then join the airport traffic pattern. Monitor the primary local control frequency as depicted on Sectional Charts for landing or traffic information, and look for a light signal which may be addressed to your aircraft. During hours of daylight, acknowledge tower transmissions or light signals by rocking your wings. At night, acknowledge by blinking the landing or navigation lights. To acknowledge tower transmissions during daylight hours, hovering helicopters will turn in the direction of the controlling facility and flash the landing light. While in flight, helicopters should show their acknowledgement of receiving a transmission by making shallow banks in opposite directions. At night, helicopters will acknowledge receipt of transmissions by flashing either the landing or the search light.

(3) Transmitter and receiver inoperative — Remain outside or above the airport traffic area until the direction and flow of traffic has been determined, then join the airport traffic pattern and maintain visual contact with the tower to receive light signals. Acknowledge light signals as noted above.

b. Departing Aircraft

(1) If you experience radio failure prior to leaving the parking area, make every effort to have the equipment repaired. If you are unable to have the malfunction repaired, call the tower by telephone and request authorization to depart without two-way radio communications. If tower authorization is granted, you will be given departure information and requested to monitor the tower frequency or watch for light signals, as appropriate. During daylight hours, acknowledge tower transmissions or light signals by moving the ailerons or rudder. At night, acknowledge by blinking the landing or navigation lights. If radio malfunction occurs after departing the parking area, watch the tower for light signals or monitor tower frequency.

NOTE.— Refer to FAR—91.87 and FAR—91.77.

206. COMMUNICATIONS FOR VFR FLIGHTS

a. FSSs are allocated frequencies for different functions, for Airport Advisory Service the pilot should contact the FSS on 123.6 MHz, for example. Other FSS frequencies are listed with the FSS in the Airport/Facility Directory. If you are in doubt as to what frequency to use to contact an FSS, transmit on 122.1 MHz and advise them of the frequency you are receiving on.

b. On VFR flights, guard the voice channel of VORs for broadcasts and calls from FAA FSSs. Where the VOR voice channel is being utilized for ATIS broadcasts, pilots of VFR flights are urged to guard the voice channel of an adjacent VOR. When in contact with a control facility, notify the controller if you plan to leave the frequency.

207—219. RESERVED

Section 3. AIRPORT OPERATIONS

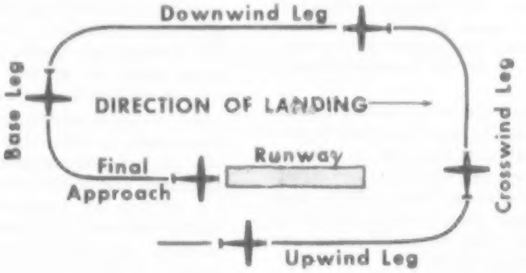
220. GENERAL

Increased traffic congestion, aircraft in climb and descent attitudes, and pilots preoccupation with cockpit duties are some factors that increase the hazardous accident potential near the airport. The situation is further compounded when the weather is marginal — that is, just meeting VFR requirements. Pilots must be particularly alert when operating in the vicinity of an airport. This section defines some rules, practices and procedures that pilots should be familiar with, and adhere to, for safe airport operations.

221. TOWER CONTROLLED AIRPORTS

a. When operating at an airport where traffic control is being exercised by a control tower, pilots are required to maintain two-way radio contact with the tower while operating within the airport traffic area unless the tower authorizes otherwise. Initial call-up should be made about 15 miles from the airport. Unless there is a good reason to leave the tower frequency before exiting the airport traffic area it is a good operating practice to remain on the tower frequency for the purpose of receiving traffic information. In the interest of reducing tower frequency congestion, pilots are reminded that it is not necessary to request permission to leave the tower frequency once outside of the airport traffic area.

b. When necessary, the tower controller will issue clearances or other information for aircraft to generally follow the desired flight path (traffic patterns) when flying in the airport traffic area/control zone, and the proper taxi routes when operating on the ground. If not otherwise authorized or directed by the tower, pilots of fixed-wing aircraft approaching to land must circle the airport to the left. Pilots approaching to land in a helicopter must avoid the flow of fixed-wing traffic. However, in all instances, an appropriate clearance must be received from the tower before landing.



NOTE.— This diagram is intended only to illustrate terminology used in identifying various components of a traffic pattern. It should not be used as a reference or guide on how to enter a traffic pattern.

c. The following terminology for the various components of a traffic pattern has been adopted as standard for use by control towers and pilots:

(1) **Upwind leg** — A flight path parallel to the landing runway in the direction of landing.

(2) **Crosswind leg** — A flight path at right angles to the landing runway off its takeoff end.

(3) **Downwind leg** — A flight path parallel to the landing runway in the opposite direction of landing.

(4) **Base leg** — A flight path at right angles to the landing runway off its approach end and extending from the downwind leg to the intersection of the extended runway centerline.

(5) **Final approach** — A flight path in the direction of landing along the extended runway centerline from the base leg to the runway.

d. Many towers are equipped with a tower radar display. The radar uses are intended to enhance the effectiveness and efficiency of the local control, or tower, position. They are not intended to provide radar services or benefits to pilots except as they may accrue through a more efficient tower operation. The four basic uses are:

(1) **To determine an aircraft's exact location** —This is accomplished by radar identifying the VFR aircraft through any of the techniques available to a radar position; such as having the aircraft ident. Once identified, the aircraft's position and spatial relationship to other aircraft can be quickly determined and standard instructions regarding VFR operation in the airport traffic area will be issued. Once initial radar identification of a VFR aircraft has been established and the appropriate instructions have been issued, radar monitoring may be discontinued. The reason being that the local controller's primary means of surveillance in VFR conditions is visually scanning the airport and local area.

(2) To provide radar traffic advisories —Radar traffic advisories may be provided to the extent that the local controller is able to monitor the radar display. Local control has primary control responsibilities to the aircraft operating on the runways which will normally supercede radar monitoring duties.

(3) To provide a direction or suggested heading — The local controller may provide pilots flying VFR with generalized instructions which will facilitate operations (e.g.,"PROCEED SOUTHWEST BOUND, ENTER A RIGHT DOWNWIND RUNWAY THREE ZERO"); or provide a suggested heading to establish radar identification or as an advisory aid to navigation (e.g., "SUGGESTED HEADING TWO TWO ZERO, FOR RADAR IDENTIFICATION"). In both cases, the instructions are advisory aids to the pilot flying VFR and are not radar vectors. PILOTS HAVE COMPLETE DISCRETION REGARDING ACCEPTANCE OF THE SUGGESTED HEADING OR DIRECTION AND HAVE SOLE RESPONSIBILITY FOR SEEING AND AVOIDING OTHER AIRCRAFT.

(4) To provide information and instructions to aircraft operating within the airport traffic area —In an example of this situation, the local controller would use the radar to advise a pilot on an extended downwind when to turn base leg.

NOTE.— The above tower radar applications are intended to augment the standard functions of the local control position. There is no controller requirement to maintain constant radar identification and, in fact, such a requirement could compromise the local controllers ability to visually scan the airport and local area to meet FAA responsibilities to the aircraft operating on the runways and within the airport traffic area. Normally, pilots will not be advised of being in radar contact since that continued status cannot be guaranteed and since the purpose of the radar identification is not to establish a link for the provision of radar services.

e. A few of the radar equipped towers are authorized to use the radar to ensure separation between aircraft in specific situations, while still others may function as limited radar approach controls. The various radar uses are strictly a function of FAA operational need. The facilities may be indistinguishable to pilots since they are all referred to as tower and no publication lists the degree of radar use. Therefore, WHEN IN COMMUNICATION WITH A TOWER CONTROLLER WHO MAY HAVE RADAR AVAILABLE, DO NOT ASSUME THAT CONSTANT RADAR MONITORING AND COMPLETE ATC RADAR SERVICES ARE BEING PROVIDED.

222. VISUAL INDICATORS AT UNCONTROLLED AIRPORTS

a. At those airports *without an operating control tower*, a segmented circle visual indicator system, if installed, is designed to provide traffic pattern information. (See PARA—157 - TRAFFIC ADVISORY PRACTICES AT AIRPORTS WHERE A TOWER IS NOT IN OPERATION). The segmented circle system consists of the following components:

(1) The segmented circle — Located in a position affording maximum visibility to pilots in the air and on the ground and providing a centralized location for other elements of the system.

(2) The Wind Direction Indicator — A wind cone, wind sock, or wind tee installed near the operational runway to indicate wind direction. The large end of the wind cone/wind sock points into the wind as does the large end (cross bar) of the wind tee. In lieu of a tetrahedron and where a wind sock or wind cone is collocated with a wind tee, the wind tee may be manually aligned with the runway in use to indicate landing direction. These signaling devices may be located in the center of the segmented circle and may be lighted for night use. Pilots are cautioned against using a tetrahedron to indicate wind direction.

(3) The Landing Direction Indicator — A tetrahedron is installed when conditions at the airport warrant its use. It may be used to indicate the direction of landings and takeoffs. A tetrahedron may be located at the center of a segmented circle and may be lighted for night operations. The small end of the tetrahedron points in the direction of landing. Pilots are cautioned against using a tetrahedron for any purpose other than as an indicator of landing direction. Further, pilots should use extreme caution when making runway selection by use of a tetrahedron in very light or calm wind conditions as the tetrahedron may not be aligned with the designated calm-wind runway. At airports with control towers, the tetrahedron should only be referenced when the control tower is not in operation. Tower instructions supersede tetrahedron indications.

(4) Landing strip indicators — Installed in pairs as shown in the segmented circle diagram and used to show the alignment of landing strips.

(5) Traffic pattern indicators — Arranged in pairs in conjunction with landing strip indicators and used to indicate the direction of turns when there is a variation from the normal left traffic pattern. (If there is no segmented circle installed at the airport, traffic pattern indicators may be installed on or near the end of the runway.)

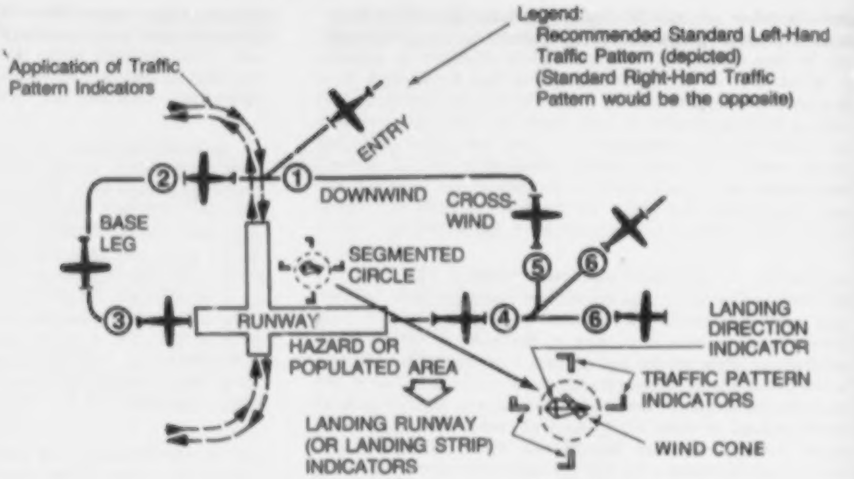
b. Preparatory to landing at an airport without a control tower, or when the control tower is not in operation, the pilot should concern himself with the indicator for the approach end of the runway to be used. When approaching for landing, all turns must be made to the left unless a traffic pattern indicator indicates that turns should be made to the right. If the pilot will mentally enlarge the indicator for the runway to be used, the base and final approach legs of the traffic pattern to be flown immediately become apparent. Similar treatment of the indicator at the departure end of the runway will clearly indicate the direction of turn after takeoff.

c. When two or more aircraft are approaching an airport for the purpose of landing, the aircraft at the lower altitude has the right of way, but it shall not take advantage of this rule to cut in front of another which is on final approach to land, or to overtake that aircraft (FAR—91.67(f)).

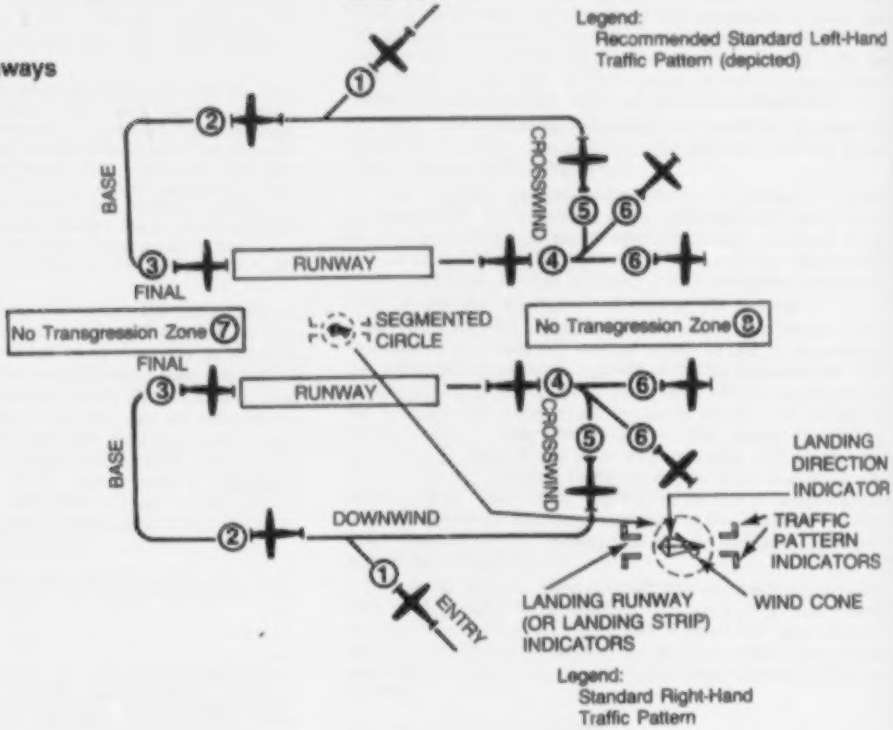
223. TRAFFIC PATTERNS

At most airports and military air bases, traffic pattern altitudes for propeller driven aircraft generally extend from 600 feet to as high as 1,500 feet above the ground. Also, traffic pattern altitudes for military turbojet aircraft sometimes extend up to 2,500 feet above the ground. Therefore, pilots of en route aircraft should be constantly on the alert for other aircraft in traffic patterns and avoid these areas whenever possible. Traffic pattern altitudes should be maintained unless otherwise required by the applicable distance from cloud criteria (FAR—91.105).

Single Runway


Legend:
Recommended Standard Left-Hand Traffic Pattern (depicted)
(Standard Right-Hand Traffic Pattern would be the opposite)
Application of Traffic Pattern Indicators
ENTRY
①
②
DOWNWIND
CROSS-WIND
BASE LEG
SEGMENTED CIRCLE
⑤
⑥
③
RUNWAY
④
⑥
LANDING DIRECTION INDICATOR
HAZARD OR POPULATED AREA
TRAFFIC PATTERN INDICATORS
LANDING RUNWAY (OR LANDING STRIP) INDICATORS
WIND CONE

Parallel Runways


Legend:
Recommended Standard Left-Hand Traffic Pattern (depicted)
①
②
BASE
CROSSWIND
⑤
⑥
③
RUNWAY
④
⑥
FINAL
No Transgression Zone ⑦
SEGMENTED CIRCLE
No Transgression Zone ⑧
FINAL
③
RUNWAY
④
⑥
BASE
CROSSWIND
⑤
⑥
LANDING DIRECTION INDICATOR
DOWNWIND
②
TRAFFIC PATTERN INDICATORS
①
ENTRY
LANDING RUNWAY (OR LANDING STRIP) INDICATORS
WIND CONE
Legend:
Standard Right-Hand Traffic Pattern

Key:

① Enter pattern in level flight, abeam the midpoint of the runway, at pattern altitude. (1000' AGL is recommended pattern altitude unless established otherwise).

② Maintain pattern altitude until abeam approach end of the landing runway, or downwind leg.

③ Complete turn to final at least ¼ mile from the runway.

④ Continue straight ahead until beyond departure end of runway.

⑤ If remaining in the traffic pattern, commence turn to crosswind leg beyond the departure end of the runway, within 300 feet of pattern altitude.

⑥ If departing the traffic pattern, continue straight out, or exit with a 45° left turn beyond the departure end of the runway, after reaching pattern altitude.

⑦ Do not overshoot final or continue on a track which will penetrate the final approach of the parallel runway.

⑧ Do not continue on a track which will penetrate the departure path of the parallel runway.

224. UNEXPECTED MANEUVERS IN THE AIRPORT TRAFFIC PATTERN

There have been several incidents in the vicinity of controlled airports that were caused primarily by aircraft executing unexpected maneuvers. ATC service is based upon observed or known traffic and airport conditions. Controllers establish the sequence of arriving and departing aircraft by requiring them to adjust flight as necessary to achieve proper spacing. These adjustments can only be based on observed traffic, accurate pilot reports, and anticipated aircraft maneuvers. Pilots are expected to cooperate so as to preclude disruption of traffic flow or creation of conflicting patterns. The pilot in command of an aircraft is directly responsible for and is the final authority as to the operation of his aircraft. On occasion it may be necessary for a pilot to maneuver his aircraft to maintain spacing with the traffic he has been sequenced to follow. The controller can anticipate minor maneuvering such as shallow "S" turns. The controller cannot, however, anticipate a major maneuver such as a 360 degree turn. If a pilot makes a 360 degree turn after he has obtained a landing sequence, the result is usually a gap in the landing interval and more importantly it causes a chain reaction which may result in a conflict with following traffic and interruption of the sequence established by the tower or approach controller. Should a pilot decide he needs to make maneuvering turns to maintain spacing behind a preceding aircraft, he should always advise the controller if at all possible. Except when requested by the controller or in emergency situations, a 360 degree turn should never be executed in the traffic pattern or when receiving radar service without first advising the controller.

225. RESERVED

226. USE OF RUNWAYS

a. Runways are identified by numbers which indicate the nearest 10-degree increment of the azimuth of the runway centerline. For example, where the magnetic azimuth is 183 degrees, the runway designation would be 18, for a magnetic azimuth of 87 degrees, the runway designation would be 9. For a magnetic azimuth ending in the number 5, such as 185, the runway designation could be either 18 or 19. Wind direction issued by the tower is also magnetic and wind velocity is in knots.

b. Airport proprietors are responsible for taking the lead in local aviation noise control. Accordingly, they may propose specific noise abatement plans to the FAA. If approved, these plans are applied in the form of Formal or Informal Runway Use Programs (see Glossary) for noise abatement purposes.

(1) At airports where no runway use program is established, ATC clearances may specify:

(a) the runway most nearly aligned with the wind when it is 5 knots or more,

(b) the "calm wind" runway when wind is less than 5 knots, or

(c) another runway if operationally advantageous.

NOTE.— It is not necessary for a controller to specifically inquire if the pilot will use a specific runway or to offer him a choice of runways. If a pilot prefers to use a different runway than that specified or the one most nearly aligned with the wind, he is expected to inform ATC accordingly.

(2) At airports where a runway use program is established, ATC will assign runways deemed to have the least noise impact. If in the interest of safety a runway different than that specified is preferred, the pilot is expected to advise ATC accordingly. ATC will honor such requests and advise pilots when the requested runway is noise sensitive. When use of a runway other than the one assigned is requested, pilot cooperation is encouraged to preclude disruption of traffic flows or creation of conflicting patterns.

227. LOW LEVEL WIND SHEAR ALERT SYSTEM (LLWAS)

a. This computerized system detects the presence of a possible hazardous low-level wind shear by continuously comparing the winds measured by sensors installed around the periphery of an airport with the wind measured at the centerfield location. If the difference between the centerfield wind sensor and a peripheral wind sensor becomes excessive, a thunderstorm or thunderstorm gust front wind shear is probable. When this condition exists, the tower controller will provide arrival and departure aircraft with an advisory of the situation which includes the centerfield wind plus the remote site location and wind.

b. Since the sensors are not all associated with specific runways, descriptions of the remote sites will be based on an eight point compass system.

EXAMPLE:

DELTA ONE TWENTY FOUR CENTERFIELD WIND TWO SEVEN ZERO AT ONE ZERO. SOUTH BOUNDARY WIND ONE FOUR ZERO AT THREE ZERO.

c. An airport equipped with the Low Level Wind Shear Alert System is so indicated in the Airport/Facility Directory under *Weather Data Sources* for that particular airport.

228. BRAKING ACTION REPORTS

a. ATC furnishes pilots the quality of braking action received from pilots or the airport management. The quality of braking action is described by the terms "good," "fair," "poor," and "nil" or a combination of these terms. Where available from airport management numerical readings from friction measuring devices, such as Mu-Meter, Saab Friction Tester, Skidometer, and Tapley Meter will be issued at pilot's request.

b. Pilots should describe the quality of braking action by using the terms noted above. In describing braking action for a portion of a runway, pilots should use descriptive terms that are easily understood, such as, "braking action poor the first/last half of the runway." Reports reference to local landmarks, buildings, etc., should be avoided.

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229. BRAKING ACTION ADVISORIES

a. When tower controllers have received runway braking action reports which include the terms *poor* or *nil*, or whenever weather conditions are conducive to deteriorating or rapidly changing runway braking conditions, the tower will include on the ATIS broadcast the statement, *"BRAKING ACTION ADVISORIES ARE IN EFFECT."*

b. During the time that Braking Action Advisories are in effect, ATC will issue the latest braking action report for the runway in use to each arriving and departing aircraft. Pilots should be prepared for deteriorating braking conditions and should request current runway condition information if not volunteered by controllers. Pilots should also be prepared to provide a descriptive runway condition report to controllers after landing.

230. INTERSECTION TAKEOFFS

a. In order to enhance airport capacities, reduce taxiing distances, minimize departure delays, and provide for more efficient movement of air traffic, controllers may initiate intersection takeoffs as well as approve them when the pilot requests. If for ANY reason a pilot prefers to use a different intersection or the full length of the runway or desires to obtain the distance between the intersection and the runway end, HE IS EXPECTED TO INFORM ATC ACCORDINGLY.

b. An aircraft is expected to taxi to (but not onto) the end of the assigned runway unless prior approval for an intersection departure is received from ground control.

c. Controllers are required to separate small aircraft (12,500 pounds or less, maximum certificated takeoff weight) departing (same or opposite direction) from an intersection behind a large nonheavy aircraft on the same runway, by ensuring that at least a 3-minute interval exists between the time the preceding large aircraft has taken off and the succeeding small aircraft begins takeoff roll. To inform the pilot of the required 3-minute hold, the controller will state, "Hold for wake turbulence." If after considering wake turbulence hazards, the pilot feels that a lesser time interval is appropriate, he may request a waiver to the 3-minute interval. Pilots must initiate such a request by stating, "Request waiver to 3-minute interval," or by making a similar statement. Controllers may then issue a takeoff clearance if other traffic permits, since the pilot has accepted responsibility for his own wake turbulence separation.

d. The 3-minute interval will not be applied when the intersection is 500 feet or less from the threshold and both aircraft are taking off in the same direction. When a small aircraft is departing from an intersection 500 feet or less from the runway threshold behind a large nonheavy aircraft and both aircraft are taking off in the same direction, the 3-minute interval will not be applied. Controllers will issue a clearance to permit the small aircraft to alter course to avoid the flight path of the preceding departure.

e. The 3-minute interval is mandatory behind a heavy aircraft in all cases.

231. SIMULTANEOUS OPERATIONS ON INTERSECTING RUNWAYS

a. Despite the many new and lengthened runways which have been added to the nation's airports in recent years, limited runway availability remains a major contributing factor to operational delays. Many high-density airports have gained operational experience with intersecting runways which clearly indicates that simultaneous operations are safe and feasible. Tower controllers may authorize simultaneous landings or a simultaneous landing and takeoff on intersecting runways when the following conditions are met:

(1) The runways are dry and the controller has received no reports that braking action is less than good.

(2) A simultaneous takeoff and landing operation may be conducted only in VFR conditions between sunrise and sunset.

(3) Instructions are issued to restrict one aircraft from entering the intersecting runway being used by another aircraft.

(4) Traffic information issued is acknowledged by the pilots of both aircraft.

(5) The measured distance from runway threshold to intersection is issued if the pilot requests it.

(6) The conditions specified in 3, 4 and 5 are met at or before issuance of the landing clearance.

(7) The distance from landing threshold to the intersection is adequate for the category of aircraft being held short. Controllers are provided a general table of aircraft category/minimum runway length requirements as a guide. Operators of STOL aircraft should identify their aircraft as such on initial contact with the tower, unless a Letter of Agreement concerning this fact, is in effect. IT IS INCUMBENT ON THE PILOT TO DETERMINE HIS ABILITY TO HOLD SHORT OF AN INTERSECTION AFTER LANDING, WHEN SO INSTRUCTED.

(8) There is no tailwind for the landing aircraft restricted to hold short of the intersection.

b. THE SAFETY AND OPERATION OF AN AIRCRAFT REMAIN THE RESPONSIBILITY OF THE PILOT. IF FOR ANY REASON, (e.g. DIFFICULTY IN DISCERNING LOCATION OF AN INTERSECTION AT NIGHT, INABILITY TO HOLD SHORT OF AN INTERSECTION, WIND FACTORS, ETC.) A PILOT ELECTS TO USE THE FULL LENGTH OF THE RUNWAY, A DIFFERENT RUNWAY OR DESIRES TO OBTAIN THE DISTANCE FROM THE LANDING THRESHOLD TO THE INTERSECTION, HE IS EXPECTED TO PROMPTLY INFORM ATC ACCORDINGLY.

232. LOW APPROACH

a. A low approach (sometimes referred to as a low pass) is the go-around maneuver following approach. Instead of landing or making a touch-and-go, a pilot may wish to go around (low approach) in order to expedite a particular operation — a series of practice instrument approaches is an example of such an operation. Unless otherwise authorized by ATC, the low approach should be made straight ahead.

with no turns or climb made until the pilot has made a thorough visual check for other aircraft in the area.

b. When operating within an airport traffic area, a pilot intending to make a low approach should contact the tower for approval. This request should be made prior to starting the final approach.

c. When operating to an airport, not within an airport traffic area, a pilot intending to make a low approach should, prior to leaving the final approach fix inbound (non precision approach) or the outer marker or fix used in lieu of the outer marker inbound (precision approach), so advise the FSS, UNICOM, or make a broadcast, as appropriate (See PARA—157 - TRAFFIC ADVISORY PRACTICES AT AIRPORTS WITHOUT OPERATING CONTROL TOWERS).

233. TRAFFIC CONTROL LIGHT SIGNALS

a. The following procedures are used by ATCTs in the control of aircraft, ground vehicles, equipment, and personnel not equipped with radio. These same procedures will be used to control aircraft, ground vehicles, equipment, and personnel equipped with radio if radio contact cannot be established. ATC personnel use a directive traffic control signal which emits an intense narrow light beam of a selected color (either red, white, or green) when controlling traffic by light signals.

b. Although the traffic signal light offers the advantage that some control may be exercised over nonradio equipped aircraft, pilots should be cognizant of the disadvantages which are:

(1) The pilot may not be looking at the control tower at the time a signal is directed toward him.

(2) The directions transmitted by a light signal are very limited since only approval or disapproval of a pilot's anticipated actions may be transmitted. No supplement or explanatory information may be transmitted except by the use of the "General Warning Signal" which advises the pilot to be on the alert.

c. Between sunset and sunrise, a pilot wishing to attract the attention of the control tower should turn on a landing light and taxi the aircraft into a position, clear of the active runway, so that light is visible to the tower. The landing light should remain on until appropriate signals are received from the tower.

d. Air Traffic Control Tower Light Gun Signals:

	MEANING		
COLOR AND TYPE OF SIGNAL	MOVEMENT OF VEHICLES EQUIPMENT AND PERSONNEL	AIRCRAFT ON THE GROUND	AIRCRAFT IN FLIGHT
Steady green	Cleared to cross, proceed or go	Cleared for takeoff	Cleared to land
Flashing green	Not applicable	Cleared for taxi	Return for landing (to be followed by steady green at the proper time)
Steady red	STOP	STOP	Give way to other aircraft and continue circling
Flashing red	Clear the taxiway/runway	Taxi clear of the runway in use	Airport unsafe, do not land
Flashing white	Return to starting point on airport	Return to starting point on airport	Not applicable
Alternating red and green	Exercise extreme caution	Exercise extreme caution	Exercise extreme caution

e. During daylight hours, acknowledge tower transmissions or light signals by moving the ailerons or rudder. At night, acknowledge by blinking the landing or navigation lights. If radio malfunction occurs after departing the parking area, watch the tower for light signals or monitor tower frequency.

234. RESERVED

235. COMMUNICATIONS

a. Pilots of departing aircraft should communicate with the control tower on the appropriate ground control/clearance delivery frequency prior to starting engines to receive engine start time, taxi and/or clearance information. Unless otherwise advised by the tower, remain on that frequency during taxiing and runup, then change to local control frequency when ready to request takeoff clearance. (See PARA. 161 - AUTOMATIC TERMINAL INFORMATION SERVICE (ATIS) for continuous broadcast of terminal information.)

b. The majority of ground control frequencies are in the 121.6—121.9 MHz bandwidth. Ground control frequencies are provided to eliminate frequency congestion on the tower (local control) frequency and are limited to communications between the tower and aircraft on the ground and between the tower and utility vehicles on the airport, provide a clear VHF channel for arriving and departing aircraft. They are used for issuance of taxi information, clear-

ances, and other necessary contacts between the tower and aircraft or other vehicles operated on the airport. A pilot who has just landed should not change from the tower frequency to the ground control frequency until he is directed to do so by the controller. Normally, only one ground control frequency is assigned at an airport; however, at locations where the amount of traffic so warrants, a second ground control frequency and/or another frequency designated as a clearance delivery frequency, may be assigned.

c. A controller may omit the ground or local control frequency if the controller believes the pilot knows which frequency is in use. If the ground control frequency is in the 121 MHz bandwidth the controller may omit the numbers preceding the decimal point; (e.g., 121.7, "CONTACT GROUND POINT SEVEN.") However, if any doubt exists as to what frequency is in use, the pilot should promptly request the controller to provide that information.

d. Controllers will normally avoid issuing a radio frequency change to helicopters, known to be single-piloted, which are hovering, air taxiing, or flying near the ground. At times, it may be necessary for pilots to alert ATC regarding single pilot operations to minimize delay of essential ATC communications. Whenever possible, ATC instructions will be relayed through the frequency being monitored until a frequency change can be accomplished. You must promptly advise ATC if you are unable to comply with a frequency change. Also, you should advise ATC if you must land to accomplish the frequency change unless it is clear the landing, e.g., on a taxiway or in a helicopter operating area, will have no impact on other air traffic.

236. GATE HOLDING DUE TO DEPARTURE DELAYS

a. Pilots should contact ground control or clearance delivery prior to starting engines as gate hold procedures will be in effect whenever departure delays exceed or are anticipated to exceed 5 minutes. The sequence for departure will be maintained in accordance with initial call up unless modified by flow control restrictions. Pilots should monitor the ground control or clearance delivery frequency for engine startup advisories or new proposed start time if the delay changes.

b. The tower controller will consider that pilots of turbine powered aircraft are ready for takeoff when they reach the runway or warm-up block unless advised otherwise.

237. VFR FLIGHTS IN TERMINAL AREAS

Use reasonable restraint in exercising the prerogative of VFR flight, especially in terminal areas. The weather minimums and distances from clouds are minimums. Giving yourself a greater margin in specific instances is just good judgment.

a. Approach Area.

Conducting a VFR operation in a Control Zone when the official visibility is 3 or 4 miles is not prohibited, but good judgment would dictate that you keep out of the approach area.

b. Reduced Visibility.

It has always been recognized that precipitation reduces forward visibility. Consequently, although again it may be perfectly legal to cancel your IFR flight plan at any time you can proceed VFR, it is good practice, when precipitation is occurring, to continue IFR operation into a terminal area until you are reasonably close to your destination.

c. Simulated Instrument Flights.

In conducting simulated instrument flights, be sure that the weather is good enough to compensate for the restricted visibility of the safety pilot and your greater concentration on your flight instruments. Give yourself a little greater margin when your flight plan lies in or near a busy airway or close to an airport.

238. VFR HELICOPTER OPERATIONS AT CONTROLLED AIRPORTS

a. GENERAL

(1) The following ATC procedures and phraseologies recognize the unique capabilities of helicopters and were developed to improve service to all users. Helicopter design characteristics and user needs often require operations from movement and nonmovement areas within the airport boundary. In order for ATC to properly apply these procedures, it is essential that pilots familiarize themselves with the local operations and make it known to controllers when additional instructions are necessary.

(2) Insofar as possible, helicopter operations will be instructed to avoid the flow of fixed-wing aircraft to minimize overall delays; however, there will be many situations where faster/larger helicopters may be integrated with fixed-wing aircraft for the benefit of all concerned. Examples would include IFR flights, avoidance of noise sensitive areas, or use of runways/taxiways to minimize the hazardous effects of rotor downwash in congested areas.

(3) Because helicopter pilots are intimately familiar with the effects of rotor downwash, they are best qualified to determine if a given operation can be conducted safely. Accordingly, the pilot has the final authority with respect to the specific airspeed/altitude combinations. ATC clearances are in no way intended to place the helicopter in a hazardous position. It is expected that pilots will advise ATC if a specific clearance will cause undue hazards to persons or property.

b. Controllers normally limit ATC ground service and instruction to ***movement*** areas; therefore, operations from ***nonmovement*** areas are conducted at pilot discretion and should be based on local policies, procedures, or letters of agreement. In order to maximize the flexibility of helicopter operations, it is necessary to rely heavily on sound pilot judgment. For example, hazards such as debris, obstructions, vehicles, or personnel must be recognized by the pilot, and action should be taken as necessary to avoid such hazards. Taxi, hover taxi, and air taxi operations are considered to be ground movements. Helicopters conducting such operations are expected to adhere to the same conditions, requirements, and practices as apply to other ground taxiing and ATC procedures in the AIM.

(1) The phraseology ***taxi*** is used when it is intended or expected that the helicopter will taxi on the airport surface, either via taxiways or other prescribed routes. ***Taxi*** is used primarily for helicopters equipped with wheels or in response to a pilot request. Preference should be given to this procedure whenever it is necessary to minimize effects of rotor downwash.

(2) Pilots may request a ***hover taxi*** when a slow forward movement is desired, or when it may be appropriate to move very short distances. Pilots should avoid this procedure if rotor downwash is likely to cause damage to parked aircraft, or if blowing dust/snow could obscure visibility. If it is necessary to operate above 25 feet AGL when hover taxiing, the pilot should initiate a request to ATC.

(3) ***Air taxi*** is the preferred method for helicopter ground movements on airports provided ground operations and conditions permit. Unless otherwise requested or instructed, pilots are expected to remain below 100 feet AGL. However, if a higher than normal airspeed or altitude is desired, the request should be made prior to lift-off. The pilot is solely responsible for selecting a safe airspeed for the altitude/operation being conducted. Use of ***air taxi*** enables the pilot to proceed at an optimum airspeed/altitude, minimize downwash effect, conserve fuel, and expedite movement from one point to another. Helicopters should avoid overflight of other aircraft, vehicles, and personnel during air-taxi operations. Caution must be exercised concerning active runways and pilots must be certain that air taxi instructions are understood. Special precautions may be necessary at unfamiliar airports or airports with multiple/intersecting active runways. The taxi procedures in PARA 241 thru PARA 243 also apply. (See Pilot/Controller Glossary - Taxi, Hover Taxi, Air Taxi definitions.)

c. Takeoff and Landing Procedures

(1) Helicopter operations may be conducted from a runway, taxiway, portion of a landing strip, or any clear area which could be used as a landing site such as the scene of an accident, a construction site, or the roof of a building. The terms used to describe designated areas from which helicopters operate are: movement area, landing/takeoff area, apron/ramp, heliport and helipad (see Pilot/Controller Glossary). These areas may be improved or unimproved and may be separate from or located on an airport/heliport. ATC will issue takeoff clearances from ***movement*** areas other than active runways, or in diverse directions from active runways, with additional instructions as necessary. Whenever possible, takeoff clearance will be issued in lieu of extended hover/air taxi operations. Phraseology will be "CLEARED FOR TAKEOFF FROM (taxiway, helipad, runway number, etc.) MAKE RIGHT/LEFT TURN FOR (direction, heading, NAVAID radial) DEPARTURE/DEPARTURE ROUTE (number, name, etc.)." Unless requested by the pilot, downwind takeoffs will not be issued if the tailwind exceeds 5 knots.

(2) Pilots should be alert to wind information as well as to wind indications in the vicinity of the helicopter. ATC should be advised of the intended method of departing. A pilot request to takeoff in a given direction indicates that the pilot is willing to accept the wind condition and controllers will honor the request if traffic permits. Departure points could be a significant distance from the control tower and it may be difficult or impossible for the controller to determine the helicopter's relative position to the wind.

(3) If takeoff is requested from ***nonmovement*** areas, the phraseology "PROCEED AS REQUESTED" will be used. Additional instructions will be issued as necessary. The pilot is responsible for operating in a safe manner and should exercise due caution. When other known traffic is not a factor and takeoff is requested from an area not visible from the tower, an area not authorized for helicopter use, an unlighted area at night, or an area not on the airport, the phraseology "DEPARTURE FROM (location) WILL BE AT YOUR OWN RISK (with reason, and additional instructions as necessary)."

(4) Similar phraseology is used for helicopter landing operations. Every effort will be made to permit helicopters to proceed direct and land as near as possible to their final destination on the airport. Traffic density, the need for detailed taxiing instructions, frequency congestion, or other factors may affect the extent to which service can be expedited. As with ground movement operations, a high degree of pilot/controller cooperation and communication is necessary to achieve safe and efficient operations.

239—240 RESERVED.

241. TAXIING

a. General: Approval must be obtained prior to moving an aircraft or vehicle onto the movement area during the hours an airport traffic control tower is in operation.

(1) Always state your position on the airport when calling the tower for taxi instructions.

(2) The movement area is normally described in local bulletins issued by the airport manager or control tower. These bulletins may be found in FSSs, fixed base operators offices, air carrier offices and operations offices.

(3) The control tower also issues bulletins describing areas where they cannot provide ATC service due to nonvisibility or other reasons.

(4) A clearance must be obtained prior to taxiing on a runway, taking off, or landing during the hours an airport traffic control tower is in operation.

(5) When ATC clears an aircraft to "taxi to" an assigned takeoff runway, the absence of holding instructions authorizes the aircraft to "cross" all runways which the taxi route intersects except the assigned takeoff runway. It does not include authorization to "taxi onto" or "cross" the assigned takeoff runway at any point. In order to preclude misunderstandings in radio communications, ATC will not use the word "cleared" in conjunction with authorization for aircraft to taxi.

(6) In the absence of holding instructions, a clearance to "taxi to" any point other than an assigned takeoff runway is a clearance to cross all runways that intersect the taxi route to that point.

(7) When ATC authorizes an aircraft to taxi to an assigned departure runway and hold short instructions will be issued, they will first specify the runway, issue taxi instructions, and then state the hold short instructions. This does not authorize the aircraft to "enter" or "cross" the assigned departure runway at any point.

b. ATC clearances or instructions pertaining to taxiing are predicated on known traffic and known physical airport conditions. Therefore, it is important that pilots clearly understand the clearance or instruction. Although an ATC clearance is issued for taxiing purposes, when operating in accordance with the FARs, it is the responsibility of the pilot to avoid collision with other aircraft. Since "the pilot in command of an aircraft is directly responsible for, and is the final authority as to, the operation of that air-

craft" the pilot should obtain clarification of any clearance or instruction which is not understood. (See PARA—540.)

c. At those airports where the U.S. Government operates the control tower and ATC has authorized noncompliance with the requirement for two-way radio communications while operating within the airport traffic area, or at those airports where the U.S. Government does not operate the control tower and radio communications cannot be established, pilots shall obtain a clearance by visual light signal prior to taxiing on a runway and prior to takeoff and landing.

d. The following phraseologies and procedures are used in radio-telephone communications with aeronautical ground stations.

(1) Request for taxi instructions prior to departure: State your aircraft identification, location, type of operation planned (VFR or IFR) and the point of first intended landing.

EXAMPLE:

Aircraft: "WASHINGTON GROUND, BEECHCRAFT ONE THREE ONE FIVE NINER AT HANGAR EIGHT, READY TO TAXI, IFR TO CHICAGO."

Tower: "BEECHCRAFT ONE THREE ONE FIVE NINER, TAXI TO RUNWAY THREE SIX, WIND ZERO THREE ZERO AT TWO FIVE, ALTIMETER THREE ZERO ZERO FOUR."

Tower: "BEECHCRAFT ONE THREE ONE FIVE NINER, RUNWAY TWO SEVEN, TAXI VIA TAXIWAYS CHARLIE AND DELTA, HOLD SHORT OF RUNWAY THREE THREE LEFT."

(2) Receipt of ATC clearance: ARTCC clearances are relayed to pilots by airport traffic controllers in the following manner:

EXAMPLE:

Tower: BEECHCRAFT ONE THREE ONE FIVE NINER CLEARED TO THE CHICAGO MIDWAY AIRPORT, VIA VICTOR EIGHT, MAINTAIN EIGHT THOUSAND.

Aircraft: "BEECHCRAFT ONE THREE ONE FIVE NINER CLEARED TO THE CHICAGO MIDWAY AIRPORT, VIA VICTOR EIGHT, MAINTAIN EIGHT THOUSAND."

NOTE.— Normally, an ATC IFR clearance is relayed to a pilot by the ground controller. At busy locations, however, pilots may be instructed by the ground controller to "CONTACT CLEARANCE DELIVERY" on a frequency designated for this purpose. No surveillance or control over the movement of traffic is exercised by this position of operation.

(3) Request for taxi instructions after landing: State your aircraft identification, location, and that you request taxi instructions.

EXAMPLE:

Aircraft: "DULLES GROUND BEECHCRAFT ONE FOUR TWO SIX ONE CLEARING RUNWAY ONE RIGHT ON TAXIWAY E3, REQUEST CLEARANCE TO PAGE."

Tower: "BEECHCRAFT ONE FOUR TWO SIX ONE, TAXI TO PAGE VIA TAXIWAYS E3, E1 and E9."

242. TAXI DURING LOW VISIBILITY

a. Pilots and aircraft operators should be constan aware that during certain low visibility conditions th movement of aircraft and vehicles on airports may not b visible to the tower controller. This may prevent visu confirmation of an aircraft's adherence to taxi instructio Pilots should, therefore, exercise extreme vigilance a proceed cautiously under such conditions.

b. Of vital importance is the need for pilots to no the controller when difficulties are encountered or at th first indication of becoming disoriented. Pilots should p ceed with extreme caution when taxiing toward the s When vision difficulties are encountered pilots should i mediately inform the controller.

243. EXITING THE RUNWAY AFTER LANDING

After landing, unless otherwise instructed by the contr tower, continue to taxi in the landing direction, proceed the nearest suitable taxiway and exit the runway witho delay. Do not turn on to another runway or make a 1 degree turn to taxi back on an active runway or ch[illegible] ground control frequency while on the active runway wi out authorization from the tower.

244. PRACTICE INSTRUMENT APPROACHES

a. Various air traffic incidents have indicated the n cessity for adoption of measures to achieve more organiz and controlled operations where practice instrument a proaches are conducted. Practice instrument approach are considered to be instrument approaches made by eith a VFR aircraft not on an IFR flight plan or an aircraft o an IFR flight plan. To achieve this and thereby enhan air safety, it is Air Traffic Operations Service policy to pr vide for separation of such operations at locations whe approach control facilities are located and, as resourc permit, at certain other locations served by ARTCCs parent approach control facilities. Pilot requests to practic instrument approaches may be approved by ATC subject traffic and workload conditions. Pilots should anticipa that in some instances the controller may find it necessar to deny approval or withdraw previous approval when tr fic conditions warrant. It must be clearly understood, ho ever, that even though the controller may be providing se aration, pilots on VFR flight plans are required to compl with basic visual flight rules (FAR—91.105). Application ATC procedures or any action taken by the controller t avoid traffic conflictions does not relieve IFR and VF pilots of their responsibility to see and avoid other traff while operating in VFR conditions. (FAR—91.67) In add tion to the normal IFR separation minimums (which i cludes visual separation) during VFR conditions, 500 fe vertical separation may be applied between VFR air and between a VFR aircraft and the IFR aircraft. Pil not on IFR flight plans desiring practice instrument a proaches should always state 'practice' when making r quests to ATC. Controllers will instruct VFR aircraft r questing an instrument approach to maintain VFR. This i to preclude misunderstandings between the pilot and co troller as to the status of the aircraft. If the pilot wishes t proceed in accordance with instrument flight rules, he must specifically request and obtain, an IFR clearance.

b. Before practicing an instrument approach, pilots should inform the approach control facility or the tower of the type of practice approach they desire to make and how they intend to terminate it, i.e., full-stop landing, touch-and-go, or missed or low approach maneuver. This information may be furnished progressively when conducting a series of approaches. Pilots on an IFR flight plan, who have made a series of instrument approaches to full stop landings should inform ATC when they make their final landing. The controller will control flights practicing instrument approaches so as to ensure that they do not disrupt the flow of arriving and departing itinerant IFR or VFR aircraft. The priority afforded itinerant aircraft over practice instrument approaches is not intended to be so rigidly applied that it causes grossly inefficient application of services. A minimum delay to itinerant traffic may be appropriate to allow an aircraft practicing an approach to complete that approach.

c. At airports without a tower, pilots wishing to make practice instrument approaches should notify the facility having control jurisdiction of the desired approach as indicated on the approach chart. All approach control facilities and ARTCCs are required to publish a Letter to Airmen depicting those airports where they provide standard separation to both VFR and IFR aircraft conducting practice instrument approaches.

d. The Controller will provide approved separation between both VFR and IFR aircraft when authorization is granted to make practice approaches to airports where an approach control facility is located and to certain other airports served by approach control or an ARTCC. Controller responsibility for separation of VFR aircraft begins at the point where the approach clearance becomes effective, or when the aircraft enters TRSA/TCA airspace, whichever comes first.

e. VFR aircraft practicing instrument approaches are not automatically authorized to execute the missed approach procedure. This authorization must be specifically requested by the pilot and approved by the controller. Separation will not be provided unless the missed approach has been approved by ATC.

f. Except in an emergency, aircraft cleared to practice instrument approaches must not deviate from the approved procedure until cleared to do so by the controller.

g. At radar approach control locations when a full approach procedure (procedure turn, etc.,) cannot be approved, pilots should expect to be vectored to a final approach course for a practice instrument approach which is compatible with the general direction of traffic at that airport.

h. When granting approval for a practice instrument approach, the controller will usually ask the pilot to report to the tower prior to or over the final approach fix inbound (non precision approaches) or over the outer marker or fix used in lieu of the outer marker inbound (precision approaches).

i. When authorization is granted to conduct practice instrument approaches to an airport with a tower, but where approved standard separation is not provided to aircraft conducting practice instrument approaches, the tower will approve the practice approach, instruct the aircraft to maintain VFR and issue traffic information, as required.

j. When an aircraft notifies a FSS providing Airport Advisory Service to the airport concerned of the intent to conduct a practice instrument approach and whether or not separation is to be provided, the pilot will be instructed to contact the appropriate facility on a specified frequency prior to initiating the approach. At airports where separation is not provided, the FSS will acknowledge the message and issue known traffic information but will neither approve or disapprove the approach.

k. Pilots conducting practice instrument approaches should be particularly alert for other aircraft operating in the local traffic pattern or in proximity to the airport.

245. OPTION APPROACH

The "Cleared for the Option" procedure will permit an instructor, flight examiner or pilot the option to make a touch-and-go, low approach, missed approach, stop-and-go, or full stop landing. This procedure can be very beneficial in a training situation in that neither the student pilot nor examinee would know what maneuver would be accomplished. The pilot should make his request for this procedure passing the final approach fix inbound on an instrument approach or entering downwind for a VFR traffic pattern. The advantages of this procedure as a training aid are that it enables an instructor or examiner to obtain the reaction of a trainee or examinee under changing conditions, the pilot would not have to discontinue an approach in the middle of the procedure due to student error or pilot proficiency requirements, and finally it allows more flexibility and economy in training programs. This procedure will only be used at those locations with an operational control tower and will be subject to ATC approval.

246. USE OF AIRCRAFT LIGHTS

a. Aircraft position and anticollision lights are required to be lighted on aircraft operated from sunset to sunrise. Anticollision lights, however, need not be lighted when the pilot in command determines that, because of operating conditions, it would be in the interest of safety to turn off the lights (FAR—91.73). For example, strobe lights should be turned off on the ground when they adversely affect ground personnel or other pilots, and in flight when there are adverse reflection from clouds.

b. An aircraft anticollision light system can use one or more rotating beacons and/or strobe lights, be colored either red or white, and have different (higher than minimum) intensities when compared to other aircraft. Many aircraft have both a rotating beacon and a strobe light system.

c. The FAA has a voluntary pilot safety program, *Operation Lights On*, to enhance the *see-and-avoid* concept. Pilots are encouraged to turn on their anticollision lights any time the engine(s) are running, day or night. Pilots are also encouraged to turn on their landing lights during takeoff; i.e., either after takeoff clearance has been received or when beginning takeoff roll. Pilots are further encouraged to turn on their landing lights when operating below 10,000 feet, day or night, especially when operating within 10 miles of any airport, or in conditions of reduced visibility and in areas where flocks of birds may be expected, i.e., coastal areas, lake areas, around refuse dumps, etc. Although turning on aircraft lights does enhance the *see-and-avoid* concept, pilots should not become complacent about keeping a sharp lookout for other aircraft. Not all aircraft are equipped with lights and some pilots may not have their lights turned on. Aircraft manufacturer's recommendations for operation of landing lights and electrical systems should be observed.

d. Prop and jet blast forces generated by large aircraft have overturned or damaged several smaller aircraft taxiing behind them. To avoid similar results, and in the interest of preventing upsets and injuries to ground personnel from such forces, the FAA recommends that air carriers and commercial operators turn on their rotating beacons anytime their aircraft engines are in operation. General aviation pilots using rotating beacon equipped aircraft are also encouraged to participate in this program which is designed to alert others to the potential hazard. Since this is a voluntary program, exercise caution and do not rely solely on the rotating beacon as an indication that aircraft engines are in operation.

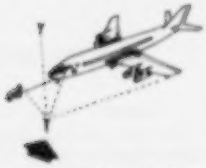
247. FLIGHT INSPECTION/'FLIGHT CHECK' AIRCRAFT IN TERMINAL AREAS

a. *Flight check* is a call sign used to alert pilots and air traffic controllers when a FAA aircraft is engaged in flight inspection/certification of NAVAIDs and flight procedures. Flight Check aircraft fly preplanned high/low altitude flight patterns such as grids, orbits, DME arcs, and tracks including low passes along the full length of the runway to verify NAVAID performance. In most instances, these flight checks are being automatically recorded and/or flown in an automated mode.

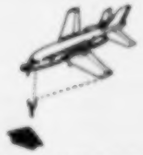
b. Pilots should be especially watchful and avoid the flight paths of any aircraft using the call sign "Flight Check" or "Flight Check recorded." The latter call sign e.g. "Flight Check 47 recorded" indicates that automated flight inspections are in progress in terminal areas. These flights will normally receive special handling from ATC. Pilot patience and cooperation in allowing uninterrupted recordings can significantly help expedite flight inspections, minimize costly, repetitive runs, and reduce the burden on the U.S. taxpayer.

248—258 RESERVED.

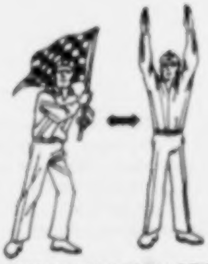
259. HAND SIGNALS



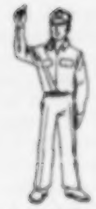
SIGNALMAN DIRECTS TOWING



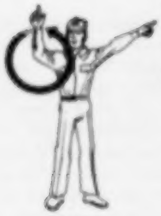
SIGNALMAN'S POSITION



FLAGMAN DIRECTS PILOT TO SIGNALMAN IF TRAFFIC CONDITIONS REQUIRE

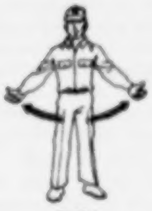


ALL CLEAR (O.K.)

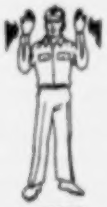


POINT TO ENGINE TO BE STARTED

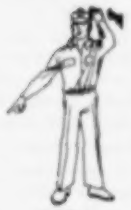
START ENGINE



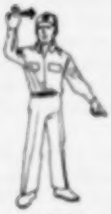
PULL CHOCKS



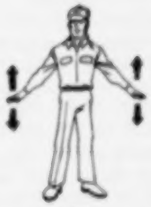
COME AHEAD



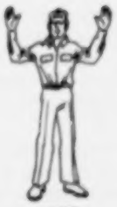
LEFT TURN



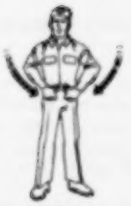
RIGHT TURN



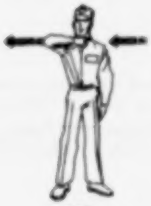
SLOW DOWN



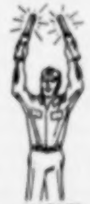
STOP



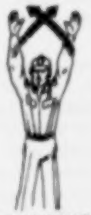
INSERT CHOCKS



CUT ENGINES



NIGHT OPERATION (Uses same hand movements as day operation)



EMERGENCY STOP

NOTES

Section 4. ATC CLEARANCES/SEPARATIONS

260. CLEARANCE

a. A clearance issued by ATC is predicated on known traffic and known physical airport conditions. An ATC clearance means an authorization by ATC, for the purpose of preventing collision between known aircraft, for an aircraft to proceed under specified conditions within controlled airspace. IT IS NOT AUTHORIZATION FOR A PILOT TO DEVIATE FROM ANY RULE REGULATION OR MINIMUM ALTITUDE NOR TO CONDUCT UNSAFE OPERATION OF HIS AIRCRAFT.

b. FAR—91.3(a) states: "The pilot in command of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft." If ATC issues a clearance that would cause a pilot to deviate from a rule or regulation, or in the pilot's opinion, would place the aircraft in jeopardy, IT IS THE PILOT'S RESPONSIBILITY TO REQUEST AN AMENDED CLEARANCE. Similarly, if a pilot prefers to follow a different course of action, such as make a 360 degree turn for spacing to follow traffic when established in a landing or approach sequence, land on a different runway, takeoff from a different intersection, takeoff from the threshold instead of an intersection or delay his operation, HE IS EXPECTED TO INFORM ATC ACCORDINGLY. When he requests a different course of action, however, the pilot is expected to cooperate so as to preclude disruption of traffic flow or creation of conflicting patterns. The pilot is also expected to use the appropriate aircraft call sign to acknowledge all ATC clearances, frequency changes, or advisory information.

c. When weather conditions permit, during the time an IFR flight is operating, it is the direct responsibility of the pilot to avoid other aircraft since VFR flights may be operating in the same area without the knowledge of ATC. Traffic clearances provide standard separation only between IFR flights.

261. CLEARANCE PREFIX

A clearance, control information, or a response to a request for information originated by an ATC facility and relayed to the pilot through an air to ground communication station will be prefixed by "ATC CLEARS," "ATC ADVISES," or "ATC REQUESTS."

262. CLEARANCE ITEMS

ATC clearances normally contain the following:

a. Clearance Limit. — The traffic clearance issued prior to departure will normally authorize flight to the airport of intended landing. Under certain conditions, at some locations a short-range clearance procedure is utilized whereby a clearance is issued to a fix within or just outside of the terminal area and the pilot is advised of the frequency on which he will receive the long-range clearance direct from the center controller.

b. Departure Procedure. — Headings to fly and altitude restrictions may be issued to separate a departure from other air traffic in the terminal area. (See PARA—322 - ABBREVIATED IFR DEPARTURE CLEARANCE PROCEDURES and PARA—325 - INSTRUMENT DEPARTURES.) Where the volume of traffic warrants, SIDs have been developed.

c. Route of Flight.

(1) Clearances are normally issued for the altitude or flight level and route filed by the pilot. However, due to traffic conditions, it is frequently necessary for ATC to specify an altitude or flight level or route different from that requested by the pilot. In addition, flow patterns have been established in certain congested areas, or between congested areas, whereby traffic capacity is increased by routing all traffic on preferred routes. Information on these flow patterns is available in offices where preflight briefing is furnished or where flight plans are accepted.

(2) When required, air traffic clearances include data to assist pilots in identifying radio reporting points. It is the responsibility of the pilot to notify ATC immediately if his radio equipment cannot receive the type of signals he must utilize to comply with his clearance.

d. Altitude Data.

(1) The altitude or flight level instructions in an ATC clearance normally require that a pilot "MAINTAIN" the altitude or flight level at which the flight will operate when in controlled airspace. Altitude or flight level changes while en route should be requested prior to the time the change is desired.

(2) When possible, if the altitude assigned is different from the altitude requested by the pilot, ATC will inform the pilot when to expect climb or descent clearance or to request altitude change from another facility. If this has not been received prior to crossing the boundary of the ATC facility's area and assignment at a different altitude is still desired, the pilot should reinitiate his request with the next facility.

(3) The term "CRUISE" may be used instead of "MAINTAIN" to assign a block of airspace, to a pilot, from the minimum IFR altitude up to and including the altitude specified in the cruise clearance. The pilot may level off at any intermediate altitude within this block of airspace. Climb/descent within the block is to be made at the discretion of the pilot. However, once the pilot starts descent and verbally reports leaving an altitude in the block, he may not return to that altitude without additional ATC clearance.

NOTE.— See definition of CRUISE in the PILOT CONTROLLER GLOSSARY.

e. Holding Instructions.

(1) Whenever an aircraft has been cleared to a fix other than the destination airport and delay is expected, it is the responsibility of the ATC controller to issue complete holding instructions (unless the pattern is charted), an EFC time, and his best estimate of any additional en route/terminal delay.

(2) If the holding pattern is charted and the controller doesn't issue complete holding instructions, the pilot is expected to hold as depicted on the appropriate chart. When the pattern is charted, the controller may omit all holding instructions except the charted holding direction and the statement *AS PUBLISHED*, e.g., *"HOLD EAST AS PUBLISHED."* Controllers shall always issue complete holding instructions when pilots request them.

NOTE.— Only those holding patterns depicted on U.S. Government or commercially produced (meeting FAA requirements) *Low/High Altitude En route, and Area or Star charts* should be used.

(3) If no holding pattern is charted and holding instructions have not been issued, the pilot should ask ATC for holding instructions prior to reaching the fix. This procedure will eliminate the possibility of an aircraft entering a holding pattern other than that desired by ATC. If the pilot is unable to obtain holding instructions prior to reaching the fix (due to frequency congestion, stuck microphone, etc.), he should hold in a standard pattern on the course on which he approached the fix and request further clearance as soon as possible. In this event, the altitude/flight level of the aircraft at the clearance limit will be protected so that separation will be provided as required.

(4) When an aircraft is 3 minutes or less from a clearance limit and a clearance beyond the fix has not been received, the pilot is expected to start a speed reduction so that he will cross the fix, initially, at or below the maximum holding airspeed.

(5) When no delay is expected, the controller should issue a clearance beyond the fix as soon as possible and, whenever possible, at least 5 minutes before the aircraft reaches the clearance limit.

(6) Pilots should report to ATC the time and altitude/flight level at which the aircraft reaches the clearance limit and report leaving the clearance limit.

NOTE.— In the event of two-way communications failure, pilots are required to comply with FAR 91.127.

263. AMENDED CLEARANCES

a. Amendments to the initial clearance will be issued at any time an air traffic controller deems such action necessary to avoid possible confliction between aircraft. Clearances will require that a flight "hold" or change altitude prior to reaching the point where standard separation from other IFR traffic would no longer exist.

NOTE.— Some pilots have questioned this action and requested "traffic information" and were at a loss when the reply indicated "no traffic report." In such cases the controller has taken action to prevent a traffic confliction which would have occurred at a distant point.

b. A pilot may wish an explanation of the handling of his flight at the time of occurrence; however, controllers are not able to take time from their immediate control duties nor can they afford to overload the ATC communications channels to furnish explanations. Pilots may obtain an explanation by directing a letter or telephone call to the chief controller of the facility involved.

c. The pilot has the privilege of requesting a different clearance from that which has been issued by ATC if he feels that he has information which would make another course of action more practicable or if aircraft equipment limitations or company procedures forbid compliance with the clearance issued.

264. SPECIAL VFR CLEARANCES

a. An ATC clearance must be obtained *prior* to operating within a control zone when the weather is less than that required for VFR flight. A VFR pilot may request and be given a clearance to enter, leave or operate within most control zones in special VFR conditions, traffic permitting, and providing such flight will not delay IFR operations. All special VFR flights must remain clear of clouds. The visibility requirements for Special VFR fixed-wing aircraft are:

(1) One mile flight visibility for operations within the control zone.

(2) One mile ground visibility if taking off or landing.

b. When a control tower is located within the control zone, requests for clearances should be to the tower. If no tower is located within the control zone, a clearance may be obtained from the nearest tower, FSS or center.

c. It is not necessary to file a complete flight plan with the request for clearance but the pilot should state his intentions in sufficient detail to permit ATC to fit his flight into the traffic flow. The clearance will not contain a specific altitude as the pilot must remain clear of clouds. The controller may require the pilot to fly at or below a certain altitude due to other traffic, but the altitude specified will permit flight at or above the minimum safe altitude. In addition, at radar locations, flights may be vectored if necessary for control purposes or on pilot request.

NOTE. The pilot is responsible for obstacle or terrain clearance (reference FAR—91.79).

d. Special VFR clearances are effective within control zones only. ATC does not provide separation after an aircraft leaves the control zone on a special VFR clearance.

e. Special VFR operations by fixed-wing aircraft are prohibited in some control zones due to the volume of IFR traffic. A list of these control zones is contained in FAR—93.113. They are also depicted on Sectional Aeronautical Charts.

f. ATC provides separation between special VFR flights and between these flights and other IFR flights.

g. Special VFR operations by fixed-wing aircraft are prohibited between sunset and sunrise unless the pilot is instrument rated and the aircraft is equipped for IFR flight.

265. PILOT RESPONSIBILITY UPON CLEARANCE ISSUANCE

a. RECORD ATC CLEARANCE — When conducting an IFR operation, make a written record of your clearance. The specified conditions which are a part of your air traffic clearance may be somewhat different from those included in your flight plan. Additionally, ATC may find it necessary to ADD conditions, such as particular departure route. The very fact that ATC specifies different or additional conditions means that other aircraft are involved in the traffic situation.

b. ATC CLEARANCE/INSTRUCTION READBACK — Pilots of airborne aircraft should read back *those parts* of

ATC clearances and instructions containing altitude assignments or vectors, as a means of mutual verification. The readback of the "numbers" serves as a double check between pilots and controllers and reduces the kinds of communications errors that occur when a number is either "misheard" or is incorrect.

(1) Precede all readbacks and acknowledgements with the aircraft identification. This aids controllers in determining that the correct aircraft received the clearance or instruction. The requirement to include aircraft identification in all readbacks and acknowledgements becomes more important as frequency congestion increases and when aircraft with similar call signs are on the same frequency.

(2) Read back altitudes, altitude restrictions, and vectors in the same sequence as they are given in the clearance or instruction.

(3) Altitudes contained in charted procedures such as SIDs, instrument approaches, etc., should not be read back unless they are specifically stated by the controller.

c. It is the responsibility of the pilot to accept or refuse the clearance issued.

266. IFR CLEARANCE VFR-ON-TOP

a. A pilot on an IFR flight plan operating in VFR weather conditions, may request VFR ON TOP in lieu of an assigned altitude. This would permit the pilot to select an altitude or flight level of his choice (subject to any ATC restrictions.)

b. Pilots desiring to climb through a cloud, haze, smoke, or other meteorological formation and then either cancel their IFR flight plan or operate VFR ON TOP may request a climb to VFR ON TOP. The ATC authorization shall contain either a top report or a statement that no top report is available, and a request to report reaching VFR ON TOP. Additionally, the ATC authorization may contain a clearance limit, routing and an alternative clearance if VFR ON TOP is not reached by a specified altitude.

c. A pilot on an IFR flight plan, operating in VFR conditions, may request to climb/descend in VFR conditions.

d. ATC may not authorize VFR ON TOP/VFR CONDITIONS operations unless the pilot requests the VFR operation or a clearance to operate in VFR CONDITIONS will result in noise abatement benefits where part of the IFR departure route does not conform to an FAA approved noise abatement route or altitude.

e. When operating in VFR conditions with an ATC authorization to "MAINTAIN VFR ON TOP/MAINTAIN VFR CONDITIONS" pilots on IFR flight plans must:

(1) Fly at the appropriate VFR altitude as prescribed in FAR—91.109.

(2) Comply with the VFR visibility and distance from cloud criteria in FAR—91.105 (BASIC VFR WEATHER MINIMUMS.)

(3) Comply with instrument flight rules that are applicable to this flight (i.e., *minimum IFR altitudes*, position reporting, radio communications, course to be flown, adherence to ATC clearance, etc.).

NOTE.— Pilots should advise ATC prior to any altitude change to insure the exchange of accurate traffic information.

f. ATC authorization to "MAINTAIN VFR ON TOP" is not intended to restrict pilots so that they must operate only *above* an obscuring meteorological formation (layer). Instead, it permits operation above, below, between layers or in areas where there is no meteorological obscuration. It is imperative, however, that pilots understand that clearance to operate "VFR ON TOP/VFR CONDITIONS" does not imply cancellation of the IFR flight plan.

g. Pilots operating VFR ON TOP/VFR CONDITIONS, may receive traffic information, from ATC, on other pertinent IFR or VFR aircraft. However, aircraft operating in TCAs/TRSAs shall be separated as required by FAA Handbook 7110.65.

NOTE.— When operating in VFR weather conditions, it is the pilot's responsibility to be vigilant so as to see and avoid other aircraft.

h. ATC will not authorize VFR or VFR ON TOP operations in PCAs. (See PARA—93 - POSITIVE CONTROL AREA.)

267—269. RESERVED

270. ADHERENCE TO CLEARANCE

a. When air traffic clearance has been obtained under either Visual or Instrument Flight Rules, the pilot in command of the aircraft shall not deviate from the provisions thereof unless an amended clearance is obtained. When ATC issues a clearance or instruction pilots are expected to execute its provisions upon receipt. ATC, in certain situations, will include the word "IMMEDIATELY" in a clearance or instruction to immpress urgency of an imminent situation and expeditious compliance by the pilot is expected and necessary for safety. The addition of a VFR or other restriction (i.e., climb or descent point or time, crossing altitude, etc.) does not authorize a pilot to deviate from the route of flight or any other provision of the ATC clearance.

b. When a heading is assigned or a turn is requested by ATC, pilots are expected to promptly initiate the turn, to complete the turn, and maintain the new heading unless issued additional instructions.

c. The term "at pilot's discretion" included in the altitude information of an ATC clearance means that ATC has offered the pilot the option to start climb or descent when he wishes. He is authorized to conduct the climb or descent at any rate he wishes, and to temporarily level off at any intermediate altitude he may desire. However, once he has vacated an altitude, he may not return to that altitude.

d. When ATC has not used the term "AT PILOT'S DISCRETION" nor imposed any climb or descent restrictions, pilots should initiate climb or descent promptly on acknowledgement of the clearance. Descend or climb at an optimum rate consistent with the operating characteristics of the aircraft to 1,000 feet above or below the assigned altitude, and then attempt to descend or climb at a rate of 500 feet per minute until the assigned altitude is reached. If at anytime the pilot is unable to climb or descend at a rate of at least 500 feet a minute, advise ATC. If it is necessary to level off at an intermediate altitude during climb or descent, advise ATC, except for level off at 10,000 feet MSL on descent or 3,000 feet above airport elevation (prior to entering an airport traffic area), when required for speed reduction (FAR—91.70).

NOTE.— Leveling off at 10,000 feet MSL on descent, or 3,000 feet above airport elevation (prior to entering in an airport traffic area), to comply with FAR—91.70 airspeed restrictions, is commonplace. Controllers anticipate this action and plan accordingly. Leveling off at any other time, on climb or descent, may seriously affect air traffic handling by ATC. Consequently, it is imperative that pilots make every effort to fulfill the above expected actions to aid ATC in safely handling and expediting traffic.

e. If the altitude information of an ATC DESCENT clearance includes a provision to "CROSS (fix) AT or AT OR ABOVE/BELOW (altitude)," "the manner in which the descent is executed to comply with the crossing altitude is at the pilot's discretion." This authorization to descend at pilot's discretion is only applicable to that portion of the flight to which the crossing altitude restriction applies, and the pilot is expected to comply with the crossing altitude as a provision of the clearance. Any other clearance in which pilot execution is optional will so state: "AT PILOT'S DISCRETION."

EXAMPLE:

"UNITED FOUR SEVENTEEN, DESCEND AND MAINTAIN SIX THOUSAND."

NOTE.— The pilot is expected to commence descent upon receipt of the clearance, and to descend at the suggested rates until reaching the assigned altitude of 6,000 feet.

EXAMPLE:

"UNITED FOUR SEVENTEEN, DESCEND AT PILOT'S DISCRETION, MAINTAIN SIX THOUSAND."

NOTE.— The pilot is authorized to conduct descent within the context of the term AT PILOT'S DISCRETION as described above.

EXAMPLE:

"UNITED FOUR SEVENTEEN, CROSS LAKEVIEW VOR AT OR ABOVE FLIGHT LEVEL TWO ZERO ZERO, DESCEND AND MAINTAIN SIX THOUSAND."

NOTE.— The pilot is authorized to conduct descent AT PILOT'S DISCRETION until reaching Lakeview VOR. He must comply with the clearance provision to cross the Lakeview VOR at or above FL 200. After passing Lakeview VOR, he is expected to descend at the suggested rates until reaching the assigned altitude of 6,000 feet.

EXAMPLE:

"UNITED FOUR SEVENTEEN, CROSS LAKEVIEW VOR AT SIX THOUSAND, MAINTAIN SIX THOUSAND."

NOTE.— The pilot is authorized to conduct descent AT PILOT'S DISCRETION, however, he must comply with the clearance provision to cross the Lakeview VOR at 6,000 feet.

EXAMPLE:

"UNITED FOUR SEVENTEEN, DESCEND NOW TO FLIGHT LEVEL TWO SEVEN ZERO, CROSS LAKEVIEW VOR AT OR BELOW ONE ZERO THOUSAND, DESCEND AND MAINTAIN SIX THOUSAND."

NOTE.— The pilot is expected to promptly execute and complete descent to FL 270 upon receipt of the clearance. After reaching FL 270 he is authorized to descend "at pilot's discretion" until reaching Lakeview VOR. He must comply with the clearance provision to cross Lakeview VOR at or below 10,000 feet. After Lakeview VOR he is expected to descend at the suggested rates until reaching 6,000 feet.

f. In case emergency authority is used to deviate from provisions of an ATC clearance, the pilot in command shall notify ATC as soon as possible and obtain an amended clearance. In an emergency situation which does not result in a deviation from the rules prescribed in FAR—91 but which requires ATC to give priority to an aircraft, the pilot of such aircraft shall, when requested by ATC, make a report within 48 hours of such emergency situation to the chief of that ATC facility.

g. The guiding principle is that the last ATC clearance has precedence over the previous ATC clearance. When the route or altitude in a previously issued clearance is amended, the controller will restate applicable altitude restrictions. If altitude to maintain is changed or restated, whether prior to departure or while airborne, and previously issued altitude restrictions are omitted, those altitude restrictions are canceled, including SID altitude restrictions.

EXAMPLE:

A departure flight receives a clearance to destination airport to maintain FL 290. The clearance incorporates a SID which has certain altitude crossing restrictions. Shortly after takeoff, the flight receives a new clearance changing the maintaining FL from 290 to 250. If the altitude restrictions are still applicable, the controller restates them.

EXAMPLE:

A departing aircraft is cleared to cross Fluky intersection at or above 3,000 feet, Gordonville VOR at or above 12,000 feet, maintain FL 200. Shortly after departure, the altitude to be maintained is changed to FL 240. If the altitude restrictions are still applicable, the controller issues an amended clearance as follows: "CROSS FLUKY INTERSECTION AT OR ABOVE THREE THOUSAND, CROSS GORDONVILLE VOR AT OR ABOVE ONE TWO THOUSAND, MAINTAIN FLIGHT LEVEL TWO FOUR ZERO.":

EXAMPLE:

An arriving aircraft is cleared to his destination airport via V45 Delta VOR direct, he is cleared to cross Delta VOR at 10,000 feet and then to, maintain 6,000 feet. Prior to Delta VOR, the controller issues amended clearance as follows: "TURN RIGHT HEADING ONE EIGHT ZERO FOR VECTOR TO RUNWAY THREE SIX ILS APPROACH, MAINTAIN 6,000."

NOTE.— Because the altitude restriction "cross Delta VOR at 10,000 feet" was omitted from the amended clearance, it is no longer in effect.

h. Pilots of turbojet aircraft equipped with afterburner engines should advise ATC prior to takeoff if they intend to use afterburning during their climb to the en route altitude. Often, the controller may be able to plan his traffic to accommodate a high performance climb and allow the pilot to climb to his planned altitude without restriction.

271. IFR SEPARATION STANDARDS

a. ATC effects separation of aircraft vertically by assigning different altitudes; longitudinally by providing an interval expressed in time or distance between aircraft on the same, converging, or crossing courses, and laterally by assigning different flight paths.

b. Separation will be provided between all aircraft operating on IFR flight plans except during that part of the flight (outside of a TCA or TRSA) being conducted on a VFR ON TOP/ VFR CONDITIONS clearance. Under these

conditions, ATC may issue traffic advisories but it is the sole responsibility of the pilot to be vigilant so as to see and avoid other aircraft.

c. When radar is employed in the separation of aircraft at the same altitude, a minimum of 3 miles separation is provided between aircraft operating within 40 miles of the radar antenna site, and 5 miles between aircraft operating beyond 40 miles from the antenna site. These minima may be increased or decreased in certain specific situations.

272. SPEED ADJUSTMENTS

a. To avoid excessive vectoring, ATC may request pilots of radar controlled aircraft to adjust speed.

b. ATC will express all speed adjustments in terms of knots based on indicated airspeed (IAS) in 10 knot increments except that at or above FL 240 speeds may be expressed in terms of mach numbers in .01 increments. The use of mach numbers is restricted to turbojet aircraft with mach meters.

c. Pilots complying with speed adjustments are expected to maintain a speed within plus or minus 10 knots or .02 mach number of the specified speed.

d. Unless pilot concurrence is obtained, ATC requests for speed adjustments will be in accordance with the following minima:

(1) To aircraft operating between FL 280 and 10,000 feet, a speed not less than 250 knots or the equivalent mach number.

(2) To turbine powered aircraft operating below 10,000 feet:

(a) A speed not less than 210 knots, except;

(b) Within 20 flying miles of the airport of intended landing, a speed not less than 170 knots.

(3) Reciprocating engine or turboprop aircraft within 20 flying miles of the runway threshold of the airport of intended landing, a speed not less than 150 knots.

(4) To departing aircraft:

(a) Turbine powered aircraft, a speed not less than 230 knots.

(b) Reciprocating engine aircraft, a speed not less than 150 knots.

e. When ATC combines a speed adjustment with a descent clearance, the sequence of delivery, with the word "then" between, indicates the expected order of execution;

EXAMPLE:

DESCEND AND MAINTAIN (altitude) THEN REDUCE SPEED TO (speed).

EXAMPLE:

REDUCE SPEED TO (speed) THEN DESCEND AND MAINTAIN (altitude).

NOTE.— The maximum speeds below 10,000 feet as established in FAR—91.70 still apply. If there is any doubt concerning the manner in which such a clearance is to be executed, request clarification from ATC.

f. If ATC determines (before an approach clearance is issued) that it is no longer necessary to apply speed adjustment procedures, they will inform the pilot to resume normal speed. Approach clearances supersede any prior speed adjustment assignments and pilots are expected to make their own speed adjustments, as necessary, to complete the approach. Under certain circumstances; however, it may be necessary for ATC to request further speed adjustments after approach clearance is issued to maintain separation between successive arrivals. Under such circumstances previously issued speed adjustments will be restated if that speed is to be maintained or additional speed adjustments are requested. ATC must obtain pilot concurrence for speed adjustments after approach clearances are issued.

g. Controllers have been advised that utilization of the minimum speeds set forth above for reciprocating engine aircraft will sometimes be impractical, since some aircraft in this category cruise at lower speeds and cannot attain the speeds specified. Speed adjustment of reciprocating engine or turbine powered aircraft which cannot attain the minimum speeds set forth shall be accomplished by requesting such flight to, if practical:

(1) Maintain a specified speed equivalent to that of the preceding or succeeding aircraft; or

(2) Increase or decrease speed utilizing increments of 10 knots or multiples thereof.

h. The pilots retain the prerogative of rejecting the application of speed adjustment by ATC if the minimum safe airspeed for any particular operation is greater than the speed adjustment. IN SUCH CASES, PILOTS ARE EXPECTED TO ADVISE ATC OF THE SPEED THAT WILL BE USED.

i. Pilots are reminded that they are responsible for rejecting the application of speed adjustment by ATC if, in their opinion, it will cause them to exceed the maximum indicated airspeed prescribed by FAR—91.70(a). IN SUCH CASES, THE PILOT IS EXPECTED TO SO INFORM ATC. Pilots operating at or above 10,000 feet MSL who are issued speed adjustments which exceed 250 knots IAS and are subsequently cleared below 10,000 feet MSL are expected to comply with FAR—91.70(a).

j. For operations in an airport traffic area, ATC is authorized to request or approve a speed greater than the maximum indicated airspeeds prescribed for operation within that airspace (FAR—91.70(b)).

k. When in communication with the ARTCC, pilots should, as a good operating practice, state any ATC assigned speed restriction on initial radio contact associated with an ATC communications frequency change.

273. RUNWAY SEPARATION

Tower controllers establish the sequence of arriving and departing aircraft by requiring them to adjust flight or ground operation as necessary to achieve proper spacing. They may "HOLD" an aircraft short of the runway to achieve spacing between it and an arriving aircraft; the controller may instruct a pilot to "EXTEND DOWNWIND" in order to establish spacing from an arriving or departing aircraft. At times a clearance may include the word "IMMEDIATE." For example: "CLEARED FOR IMMEDIATE TAKEOFF." In such cases "IMMEDIATE" is used for purposes of *air traffic separation.* It is up to the pilot to refuse the clearance if, in his opinion, compliance would adversely affect his operation. (See PARA—236. - GATE HOLDING DUE TO DEPARTURE DELAYS.)

274. VISUAL SEPARATION

a. Visual separation is a means employed by ATC to separate aircraft only in terminal areas. There are two methods employed to effect this separation:

(1) The tower controller sees the aircraft involved and issues instructions, as necessary, to ensure that the aircraft avoid each other.

(2) A pilot sees the other aircraft involved and upon instructions from the controller provides his own separation by maneuvering his aircraft to avoid it. This may involve following in-trail behind another aircraft or keeping it in sight until it is no longer a factor.

b. A pilot's acceptance of instructions to follow another aircraft or provide visual separation from it is an acknowledgment that the pilot will maneuver his/her aircraft as necessary to avoid the other aircraft or to maintain in-trail separation. In operations conducted behind heavy jet aircraft, it is also an acknowledgment that the pilot accepts the responsibility for wake turbulence separation.

c. WHEN A PILOT HAS BEEN TOLD TO FOLLOW ANOTHER AIRCRAFT OR TO PROVIDE VISUAL SEPARATION FROM IT HE/SHE SHOULD PROMPTLY NOTIFY THE CONTROLLER IF VISUAL CONTACT WITH THE OTHER AIRCRAFT IS LOST OR CANNOT BE MAINTAINED OR IF THE PILOT CANNOT ACCEPT THE RESPONSIBILITY FOR THE SEPARATION FOR ANY REASON.

d. Pilots should remember, however, that they have a regulatory responsibility (FAR 91.67(a)) to see and avoid other aircraft when weather conditions permit.

275. USE OF VISUAL CLEARING PROCEDURES

a. **Before Takeoff.** Prior to taxiing onto a runway or landing area in preparation for takeoff, pilots should scan the approach areas for possible landing traffic, executing appropriate clearing maneuvers to provide him a clear view of the approach areas.

b. **Climbs and Descents.** During climbs and descents in flight conditions which permit visual detection of other traffic, pilots should execute gentle banks, left and right at a frequency which permits continuous visual scanning of the airspace about them.

c. **Straight and level.** Sustained periods of straight and level flight in conditions which permit visual detection of other traffic should be broken at intervals with appropriate clearing procedures to provide effective visual scanning.

d. **Traffic pattern.** Entries into traffic patterns while descending create specific collision hazards and should be avoided.

e. **Traffic at VOR sites.** All operators should emphasize the need for sustained vigilance in the vicinity of VORs and airway intersections due to the convergence of traffic.

f. **Training operations.** Operators of pilot training programs are urged to adopt the following practices:

(1) Pilots undergoing flight instruction at all levels should be requested to verbalize clearing procedures (call out, "clear" left, right, above or below) to instill and sustain the habit of vigilance during maneuvering.

(2) High-wing airplane, momentarily raise the wing in the direction of the intended turn and look.

(3) Low-wing airplane, momentarily lower the wing in the direction of the intended turn and look.

(4) Appropriate clearing procedures should precede the execution of all turns including chandelles, lazy eights, stalls, slow flight, climbs, straight and level, spins and other combination maneuvers.

276—289. RESERVED

Section 5. PREFLIGHT

290. PREFLIGHT PREPARATION

a. Every pilot is urged to receive a preflight briefing and to file a flight plan. This briefing should consist of weather, airport, and en route NAVAID information. Briefing service may be obtained from a FSS either by telephone or interphone, by radio when airborne, or by a personal visit to the station.

b. For your convenience, you are urged to use the Flight Planner which is printed on FAA Form 8740-2. It provides a flight log, a reproduction of FAA Form 7233-1, Flight Plan, blocks to record weather and aeronautical data and a "go or no go" checklist. The Flight Planner and Flight Plan forms are available for use at all flight service stations. Additional copies will be provided on request.

c. Consult an FSS or Weather Service Office (WSO) for preflight weather briefing.

d. FSSs are required to advise of pertinent NOTAMs, but if they are overlooked, don't hesitate to remind the specialist that you have not received NOTAM information.

NOTE.— NOTAMS which are known in sufficient time for publication and are of 7 days duration or longer are normally incorporated into the Notices to Airmen (Class II) publication and carried there until cancellation time. FDC NOTAMs, which apply to instrument flight procedures, are also included in the Notices to Airmen publication up to and including the number indicated in the FDC NOTAM legend. Class II NOTAMs are not provided during a briefing unless specifically requested by the pilot since the FSS specialist has no way of knowing whether the pilot has already checked the Notices to Airmen (Class II) publication prior to calling. Remember to *ask* for Class II NOTAMs in the Notices to Airmen publication. This information is not normally furnished during your briefing. (See PARA—294 - NOTICE TO AIRMEN (NOTAM) SYSTEM.)

e. Pilots are urged to use only the latest issue of aeronautical charts in planning and conducting flight operations. Aeronautical charts are revised and reissued on a regular scheduled basis to ensure that depicted data are current and reliable. In the conterminous U.S., Sectional Charts are updated each 6 months, IFR En route Charts each 56 days, and amendments to civil IFR Approach Charts are accomplished on a 56 day cycle with a change notice volume issued on the 28 day midcycle. Charts that have been superseded by those of a more recent date may contain obsolete or incomplete flight information. (See PARA—623 - GENERAL DESCRIPTION OF EACH CHART SERIES.)

f. When requesting a preflight briefing, identify yourself as a pilot and provide the following:

(1) Type of flight planned, e.g., VFR or IFR.

(2) Aircraft number or pilot's name.

(3) Aircraft type.

(4) Departure Airport.

(5) Route of flight.

(6) Destination.

(7) Flight altitude(s).

(8) ETD and ETE.

g. Prior to conducting a briefing, briefers are required to have the background information listed above so that they may tailor the briefing to the needs of the proposed flight. The objective is to communicate a "picture" of meteorological and aeronautical information necessary for the conduct of a safe and efficient flight. Briefers use all available weather and aeronautical information to summarize data applicable to the proposed flight. They do not read weather reports and forecasts verbatim unless specifically requested by the pilot. Refer to PARA—502 for those items of a weather briefing that should be expected or requested.

h. In addition to the filing of a flight plan, if the flight will traverse or land in one or more foreign countries, it is particularly important that pilots leave a complete itinerary with someone directly concerned, keep that person advised of the flight's progress and inform him that, if serious doubt arises as to the safety of the flight, he should first contact the FSS. (See PARA—300 - FLIGHTS OUTSIDE THE UNITED STATES AND U.S. TERRITORIES.)

i. Pilots operating under provisions of FAR—135, and not having an FAA assigned 3-letter designator, are urged to prefix the normal registration (N) number with the letter "T" on flight plan filing, (e.g., TN1234B). (See PARA—193 - AIRCRAFT CALL SIGNS.)

291. FOLLOW IFR PROCEDURES EVEN WHEN OPERATING VFR

a. To maintain IFR proficiency, pilots are urged to practice IFR procedures whenever possible, even when operating VFR. Some suggested practices include:

(1) Obtain a complete preflight and weather briefing. Check the NOTAMS.

(2) File a flight plan. This is an excellent low cost insurance policy. The cost is the time it takes to fill it out. The insurance includes the knowledge that someone will be looking for you if you become overdue at your destination.

(3) Use current charts.

(4) Use the navigation aids. Practice maintaining a good course—keep the needle centered.

(5) Maintain a constant altitude which is appropriate for the direction of flight.

(6) Estimate en route position times.

(7) Make accurate and frequent position reports to the FSSs along your route of flight.

b. Simulated IFR flight is recommended (under the hood); however, pilots are cautioned to review and adhere to the requirements specified in FAR—91.21 before and during such flight.

c. When flying VFR at night, in addition to the altitude appropriate for the direction of flight, pilots should maintain an altitude which is at or above the minimum en route altitude as shown on charts. This is especially true in mountainous terrain, where there is usually very little ground reference. Do not depend on your eyes alone to avoid rising unlighted terrain, or even lighted obstructions such as TV towers.

292—293. RESERVED

294. NOTICE TO AIRMEN (NOTAM) SYSTEM

a. Time-critical aeronautical information which is of either a temporary nature or is not sufficiently known in advance to permit publication on aeronautical charts or in other operational publications, receives immediate dissemination via the National Notice to Airmen (NOTAM) System.

NOTE.— NOTAM information is that aeronautical information that could affect a pilot's decision to make a flight. It includes such information as airport or primary runway closures, changes in the status of navigational aids, ILSs, radar service availability, and other information essential to planned enroute, terminal or landing operations.

b. NOTAM information is classified into three categories. These are NOTAM (D) or distant, NOTAM (L) or local, and Flight Data Center (FDC) NOTAMs.

(1) NOTAM (D)

(a) NOTAM (D) information is disseminated for all navigational facilities that are part of the National Airspace System (NAS), all IFR airports with approved IAPs, and for those VFR airports annotated with the Notam Service Symbol(§) in the Airport/Facility Directory (A/FD). The complete file of all NOTAM (D) information is maintained in a computer data base at the National Communications Center (NATCOM), located in Kansas City. This category of information is distributed automatically, appended to the hourly weather reports, via the Service A telecommunications system. Air traffic facilities, primarily FSS, with Service A capability, have access to the entire NATCOM data base of NOTAMs. These NOTAMs remain available via Service A for the duration of their validity or until published.

(2) NOTAM (L)

(a) NOTAM (L) information includes such data as taxiway closures, men and equipment near or crossing runways, airport rotating beacon outages, and airport lighting aids that do not affect instrument approach criteria, such as VASI. This category of NOTAM also contains all NOTAM information concerning airports that are not annotated with the Notam Service Symbol in the A/FD, including airport and runway closures.

(b) NOTAM (L) information is distributed locally only, and is not attached to the hourly weather reports. A separate file of local NOTAMs is maintained at each FSS, for facilities in their area only. NOTAM (L) information for other FSS areas must be specifically requested directly from the FSS that has responsibility for the airport concerned.

(3) FDC NOTAMS

(a) On those occasions when it becomes necessary to disseminate information which is regulatory in nature, the National Flight Data Center (NFDC), in Washington, D.C., will issue an FDC NOTAM. FDC NOTAMs contain such things as amendments to published IAPs and other current aeronautical charts. They are also used to advertise temporary flight restrictions caused by such things as natural disasters or large scale public events, that may generate a congestion of air traffic over a site.

(b) FDC NOTAMs are transmitted via Service A only once, and are kept on file at the FSS until published or cancelled. FSSs are responsible for maintaining a file of current, unpublished FDC NOTAMs concerning conditions within 400 miles of their facilities. FDC information concering conditions that are more than 400 miles from the FSS, or that is already published, is given to a pilot only on request.

c. An integral part of the NOTAM System is the biweekly Notice to Airmen (Class II) publication. Data is included in this publication to reduce congestion on the telecommunications circuits, and therefore is not available via Service A. This information once published, is not provided during pilot weather briefings unless specifically requested by the pilot.

NOTE.— The term "Class II" refers to the fact that the NOTAMs or notices, appear in printed form for mail distribution as opposed to NOTAMs which are distributed via telecommunications. The latter are considered Class I.

(1) This publication contains two sections:

(a) The first section consists of notices which meet the criteria for NOTAM (D), and are expected to remain in effect for an extended period, and FDC NOTAMs current at the time of publication. Occasionally, some NOTAM (L) and other unique information is included in this section when it will contribute to flight safety.

(b) The second section contains special notices that are too long or concern a wide or unspecified geographic area and are not suitable for inclusion in the first section. The content of these notices vary widely and there are no specific criteria for their inclusion, other than their enhancement of flight safety.

(c) The number of the last FDC NOTAM included in the publication, is noted on the first page to aid the user, in updating the listing contained, with any FDC NOTAMs which may have been issued between the cut-off date and the date the publication is received. All information contained will be carried until the information expires, is cancelled, or in the case of permanent conditions, is published in other publications, such as the A/FD.

(d) All new notices entered, excluding FDC NOTAMs, will be published only if the information is expected to remain in effect for at least 7 days after the effective date of the publication.

295. FLIGHT PLAN — VFR FLIGHTS

a. Except for operations in or penetrating a Coastal or Domestic ADIZ or DEWIZ (See PARA—430 - NATIONAL SECURITY), a flight plan is not required for VFR flight. However, it is strongly recommended that one be filed with an FAA FSS. This will ensure that you receive VFR Search and Rescue Protection. (Refer to PARA—456.g. for the proper method of filing.)

b. To obtain maximum benefits from the flight plan program, flight plans should be filed directly with the nearest FSS. For your convenience, FSSs provide aeronautical and meteorological briefings while accepting flight plans. Radio may be used to file if no other means are available.

NOTE.— Some states operate aeronautical communications facilities which will accept and forward flight plans to the FSS for further handling.

c. When a "stopover" flight is anticipated, it is recommended that a separate flight plan be filed for each "leg" when the stop is expected to be more than 1 hour duration.

d. Pilots are encouraged to give their departure times directly to the FSS serving the departure airport or as otherwise indicated by the FSS when the flight plan is filed. This will ensure more efficient flight plan service and permit the FSS to advise you of significant changes in aeronautical facilities or meteorological conditions. When a VFR flight plan is filed, it will be held by the FSS until 1 hour after the proposed departure time unless:

(1) The actual departure time is received.

(2) A revised proposed departure time is received.

(3) At a time of filing, the FSS is informed that the proposed departure time will be met, but actual time cannot be given because of inadequate communications (assumed departures).

e. On pilot's request, at a location having an active tower, the aircraft identification will be forwarded by the FSS to the tower for reporting the actual departure time. This procedure should be avoided at busy airports.

f. Although position reports are not required for VFR flight plans, periodic reports to FAA, FSSs along the route are good practice. Such contacts permit significant information to be passed to the transiting aircraft and also serve to check the progress of the flight should it be necessary for any reason to locate the aircraft.

EXAMPLE:

BONANZA 314K, OVER KINGFISHER AT (Time), VFR FLIGHT PLAN, TULSA TO AMARILLO.

EXAMPLE:

CHEROKEE 5133J, OVER OKLAHOMA CITY AT (Time), SHREVEPORT TO DENVER, NO FLIGHT PLAN.

g. Pilots not operating on an IFR flight plan, and when in level cruising flight, are cautioned to conform with VFR cruising altitudes appropriate to direction of flight.

h. Indicate aircraft equipment capabilities when filing VFR flight plans by appending the appropriate suffix to aircraft type in the same manner as that prescribed for IFR flight (see PARA—298 — FLIGHT PLAN - IFR FLIGHTS). Under some circumstances, ATC computer tapes can be useful in constructing the radar history of a downed or crashed aircraft. In each case, knowledge of the aircraft's transponder equipment is necessary in determining whether or not such computer tapes might prove effective.

296. FLIGHT PLAN — DEFENSE VFR (DVFR) FLIGHTS

VFR flights into a Coastal or Domestic ADIZ/DEWIZ are required to file a VFR flight plan for security purposes. Detailed ADIZ procedures are found in the National Security section of this chapter. (See FAR—99.)

297. COMPOSITE FLIGHT PLAN (VFR/IFR FLIGHTS)

a. Flight plans which specify VFR operation for one portion of a flight, and IFR for another portion, will be accepted by the FSS at the point of departure. If VFR flight is conducted for the first portion of the flight, the pilot should report his departure time to the FSS with which he filed his VFR/IFR flight plan; and, subsequently, close the VFR portion and request ATC clearance from the FSS nearest the point at which change from VFR to IFR is proposed. Regardless of the type facility you are communicating with (FSS, center, or tower), it is the pilot's responsibility to request that facility to "CLOSE VFR FLIGHT PLAN." The pilot must remain in VFR weather conditions until operating in accordance with the IFR clearance.

b. When a flight plan indicates IFR for the first portion of flight and VFR for the latter portion, the pilot will normally be cleared to the point at which the change is proposed. Once the pilot has reported over the clearance limit and does not desire further IFR clearance, he should advise ATC to cancel the IFR portion of his flight plan. Then, he should contact the nearest FSS to activate the VFR portion of his flight plan. If the pilot desires to continue his IFR flight plan beyond the clearance limit, he should contact ATC at least 5 minutes prior to the clearance limit and request further IFR clearance. If the requested clearance is not received prior to reaching the clearance limit fix, the pilot will be expected to established himself in a standard holding pattern on the radial or course to the fix unless a holding pattern for the clearance limit fix is depicted on a U.S. Government or commercially produced (meeting FAA requirements) Low or High Altitude En Route, Area or STAR Chart. In this case the pilot will hold according to the depicted pattern.

298. FLIGHT PLAN — IFR FLIGHTS

a. GENERAL

(1) Prior to departure from within, or prior to entering controlled airspace, a pilot must submit a complete flight plan and receive an air traffic clearance, if weather conditions are below VFR minimums. Instrument flight plans may be submitted to the nearest FSSs or ATCT either in person or by telephone (or by radio if no other means are available). Pilots should file IFR flight plans at least 30 minutes prior to estimated time of departure to preclude possible delay in receiving a departure clearance from ATC. To minimize your delay in entering the control zone at destination when IFR weather conditions exist or are forecast at that airport, an IFR flight plan should be filed before departure. Otherwise, a 30 minute delay is not unusual in receiving an ATC clearance because of time spent in processing flight plan data. Traffic saturation frequently prevents control personnel from accepting flight plans by radio. In such cases, the pilot is advised to contact the nearest FSS for the purpose of filing the flight plan.

NOTE.— There are several methods of obtaining IFR clearances at nontower, non-FSSs, and outlying airports. The procedure may vary due to geographical features, weather conditions, and the complexity of the ATC system. To determine the most effective means of receiving an IFR clearance, pilots should ask the nearest FSS the most appropriate means of obtaining the IFR clearance.

(2) When filing an IFR flight plan for a Heavy aircraft, add the prefix H to the aircraft type.

EXAMPLE:

H/DC10/U

(3) When filing an IFR flight plan for flight in an aircraft equipped with a radar beacon transponder, DME equipment, TACAN only equipment or a combination of both, identify equipment capability by adding a suffix to the AIRCRAFT TYPE preceded by a slant, as follows:

/X — no transponder.

/T — transponder with no altitude encoding capability.

/U — transponder with altitude encoding capability.

/D — DME, but no transponder.

/B — DME and transponder, but no altitude encoding capability.

/A — DME and transponder with altitude encoding capability.

/M — TACAN only, but no transponder.

/N — TACAN only and transponder, but with no altitude encoding capability.

/P — TACAN only and transponder with altitude encoding capability.

/C — RNAV and transponder, but with no altitude encoding capability.

/R — RNAV and transponder with altitude encoding capability.

/W — RNAV but no transponder.

(4) It is recommended that pilots file the maximum transponder or navigation capability of their aircraft in the equipment suffix. This will provide ATC with the necessary information to utilize all facets of navigational equipment and transponder capabilities available. In the case of area navigation equipped aircraft, pilots should file the /C, /R, or /W capability of the aircraft even though an RNAV route or random RNAV route has not been requested. This will ensure ATC awareness of the pilot's ability to navigate point-to-point and may be utilized to expedite the flight.

NOTE.— The suffix is not to be added to the aircraft identification or be transmitted by radio as part of the aircraft identification.

b. AIRWAYS/JET ROUTES DEPICTION ON FLIGHT PLAN

(1) It is vitally important that the route of flight be accurately and completely described in the flight plan. To simplify definition of the proposed route, and to facilitate ATC, pilots are requested to file via airways or jet routes established for use at the altitude or flight level planned.

(2) If flight is to be conducted via designated airways or jet routes, describe the route by indicating the type and number designators of the airway(s) or jet route(s) requested. If more than one airway or jet route is to be used, clearly indicate points of transition. If the transition is made at an unnamed intersection, show the next succeeding NAVAID or named intersection on the intended route and the complete route from that point. Reporting points may be identified by using authorized name/code as depicted on appropriate aeronautical charts. The following two examples illustrate the need to specifiy the transition point when two routes share more than one transition fix.

EXAMPLE:

FL 250 ALB J37 BUMPY J14 BHM

SPELLED OUT: Requesting Flight Level 250 from Albany, New York, via Jet Route 37 transitioning to Jet Route 14 at BUMPY intersection, thence via Jet Route 14 to Birmingham, Alabama.

EXAMPLE:

FL 250 ALB J37 ENO J14 BHM

SPELLED OUT: Requesting Flight Level 250 from Albany, New York, via Jet Route 37 transitioning to Jet Route 14 at Kenton VORTAC (ENO) thence via Jet Route 14 to Birmingham, Alabama.

(a) The route of flight may also be described by naming the reporting points or NAVAIDs over which the flight will pass, provided the points named are established for use at the altitude or flight level planned.

EXAMPLE:

30 BWI V44 SWANN V433 DQO

SPELLED OUT: Requesting 3,000 feet from Baltimore-Washington International, via Victor 44 To Swann Intersection, transitioning to Victor 433 at Swann, thence via V433 to Dupont.

(b) When the route of flight is defined by named reporting points, whether alone or in combination with airways or jet routes, and the navigational aids (VOR, VORTAC, TACAN, NDB) to be used for the flight are a combination of different types of aids, enough information should be included to clearly indicate the route requested.

EXAMPLE:

FL 310 LAX J5 LKV J3 GEG YXC FL 330 HL500 VLR HL515 YWG

SPELLED OUT: Requesting FL 310 from Los Angeles International via Jet Route 5 Lakeview, Jet Route 3 Spokane, direct Kimberly, British Columbia Low Frequency Range, Flight Level 330 High Level Airway 500 to Langruth, Manitoba VOR, High Level Airway 515 to Winnipeg, Manitoba.

(c) When filing IFR, it is to the pilot's advantage to file a preferred route.

NOTE.— Preferred IFR routes are described and tabulated in the Airport/Facility Directory.

(d) ATC may issue a SID or a STAR, as appropriate. (See PARA—325 - INSTRUMENT DEPARTURE and PARA—360 - STANDARD TERMINAL ARRIVAL (STAR).

NOTE.— Pilots not desiring a SID or STAR should so indicate in the remarks section of the flight plan as "NO SID" or "NO STAR".

c. DIRECT FLIGHTS

(1) All or any portions of the route which will not be flown on the radials or courses of established airways or routes, such as direct route flights, must be defined by indicating the radio fixes over which the flight will pass. Fixes selected to define the route shall be those over which the position of the aircraft can be accurately determined. Such fixes automatically become compulsory reporting points for the flight, unless advised otherwise by ATC. Only those navigational aids established for use in a particular structure, i.e., in the low or high structures, may be used to define the en route phase of a direct flight within that altitude structure.

(2) The azimuth feature of VOR aids and that azimuth and distance (DME) features of VORTAC and TACAN aids are assigned certain frequency protected areas of airspace which are intended for application to established airway and route use, and to provide guidance for planning flights outside of established airways or routes. These areas of airspace are expressed in terms of cylindrical service volumes of specified dimensions called "class limits" or "categories." (See PARA—10 - CLASS OF NAVAIDs.) An operational service volume has been established for each class in which adequate signal coverage and frequency protection can be assured. To facilitate use of VOR, VORTAC or TACAN aids, consistent with their operational service volume limits, pilot use of such aids for defining a direct route of flight in controlled airspace should not exceed the following:

(a) Operations above FL 450 — use aids not more than 200 NM apart. These aids are depicted on En Route High Altitude Charts.

(b) Operation off established routes from 18,000 feet MSL to FL 450 - use aids not more than 260 NM apart. These aids are depicted on En Route High Altitude Charts.

(c) Operation off established airways below 18,000 feet MSL — use aids not more than 80 NM apart. These aids are depicted on En Route Low Altitude Charts.

(d) Operation off established airways between 14,500 feet MSL and 17,999 feet MSL in the conterminous U.S. — (H) facilities not more than 200 NM apart may be used.

(3) Increasing use of self-contained airborne navigational systems which do not rely on the VOR/VORTAC/TACAN system has resulted in pilot requests for direct routes which exceed NAVAID service volume limits. These direct route requests will be approved only in a radar environment, with approval based on pilot responsibility for navigation on the authorized direct route. Radar flight following will be provided by ATC for ATC purposes.

(4) At times, ATC will initiate a direct route in a radar environment which exceeds NAVAID service volume limits. In such cases ATC will provide radar monitoring and navigational assistance as necessary.

(5) Airway or jet route numbers, appropriate to the stratum in which operation will be conducted, may also be included to describe portions of the route to be flown.

EXAMPLE:

140 MDW V262 BDF V10 BRL STJ SLN GCK

SPELLED OUT: Requesting 14,000 feet from Chicago Midway Airport via Victor 262 to Bradford, Victor 10 to Burlington, Iowa, direct St. Joseph, Missouri, direct Salina, Kansas, direct Garden City, Kansas.

NOTE.— When route of flight is described by radio fixes, the pilot will be expected to fly a direct course between the points named.

(6) Pilots are reminded that they are responsible for adhering to obstruction clearance requirements on those segments of direct routes that are outside of controlled airspace. The MEA's and other altitudes shown on Low Altitude IFR En Route Charts pertain to those route segments within controlled airspace, and those altitudes may not meet obstruction clearance criteria when operating off those routes.

d. AREA NAVIGATION (RNAV)

(1) Random RNAV routes can only be approved in a radar environment. Factors that will be considered by ATC in approving random RNAV routes include the capability to provide radar monitoring and compatibility with traffic volume and flow. ATC will radar monitor each flight, however, navigation on the random RNAV route is the responsibility of the pilot.

(2) To be certified for use in the National Airspace System, RNAV equipment must meet the specifications outlined in AC 90-45. The pilot is responsible for variations in equipment capability, and must advise ATC if a RNAV clearance can not be accepted as specified. The controller need only be concerned that the aircraft is RNAV equipped; if the flight plan equipment suffix denotes RNAV capability, the RNAV routing can be applied.

(3) Pilots of aircraft equipped with operational area navigation equipment may file for random RNAV routes throughout the National Airspace System, where radar monitoring by ATC is available, in accordance with the following procedures.

(a) File airport to airport flight plans prior to departure.

(b) File the appropriate RNAV capability certification suffix in the flight plan.

(c) Plan the random route portion of the flight plan to begin and end over appropriate arrival and departure transition fixes or appropriate navigation aids for the altitude stratum within which the flight will be conducted. The use of normal preferred departure and arrival routes (SID/STAR), where established, is recommended.

(d) File route structure transitions to and from the random route portion of the flight.

(e) Define the random route by waypoints. File route description waypoints by using degree-distance fixes based on navigational aids which are appropriate for the altitude stratum.

(f) File a minimum of one route description waypoint for each ARTCC through whose area the random route will be flown. These waypoints must be located within 200 NM of the preceding center's boundary.

(g) File an additional route description waypoint for each turnpoint in the route.

(h) Plan additional route description waypoints as required to ensure accurate navigation via the filed route of flight. Navigation is the pilots's responsibility unless ATC assistance is requested.

(i) Plan the route of flight so as to avoid Prohibited and Restricted Airspace by 3 NM unless permission has been obtained to operate in that airspace and the appropriate ATC facilities are advised.

(4) Pilots of aircraft equipped with latitude/longitude coordinate navigation capability, independent of VOR/TACAN references, may file for random RNAV routes at and above FL 390, within the conterminous United States, using the following procedures.

(a) File airport to airport flight plans prior to departure.

(b) File the appropriate RNAV capability certification suffix in the flight plan.

(c) Plan the random route portion of the flight to begin and end over published departure/arrival transition fixes or appropriate navigation aids for airports without published transition procedures. The use of preferred departure and arrival routes, such as SID and STAR where established, is recommended.

(d) Plan the route of flight so as to avoid prohibited and restricted airspace by 3 NM unless permission has been obtained to operate in that airspace and the appropriate ATC facility is advised.

(e) Define the route of flight after the departure fix, including each intermediate fix (turnpoint) and the arrival fix for the destination airport in terms of latitude/longitude coordinates plotted to the nearest minute. The arrival fix must be identified by both the latitude/longitude coordinates and a fix identifier.

Example:

MIA [1] SRQ [2] 3407/10615 [3] 3407/11546 TNP [4] LAX [5]

1. Departure airport.
2. Departure fix.
3. Intermediate fix (turning point).
4. Arrival fix.
5. Destination airport.

(f) Record latitude/longitude coordinates by four figures describing latitude in degrees and minutes followed by a solidus and five figures describing longitude in degrees and minutes.

(g) File at FL 390 or above for the random RNAV portion of the flight.

(h) Fly all routes/route segments on Great Circle tracks.

(i) Make any inflight requests for random RNAV clearances or route amendments to an en route ATC facility.

299. IFR OPERATIONS TO HIGH ALTITUDE DESTINATIONS

a. Pilots planning IFR flights to airports located in mountainous terrain are cautioned to consider the necessity for an alternate airport even when the forecast weather conditions would technically relieve them from the requirement to file one (Reference: FAR—91.23(b)). The FAA has identified three possible situations where the failure to plan for an alternate airport when flying IFR to such a destination airport could result in a critical situation if the weather is less than forecast and sufficient fuel is not available to proceed to a suitable airport.

(1) An IFR flight to an airport where the MDAs or landing visibility minimums for *ALL INSTRUMENT APPROACHES* are higher than the forecast weather minimums specified in FAR—91.23(b). For example, there are 10 high altitude airports in the United States with approved instrument approach procedures where all of the Minimum Descent Altitudes (MDAs) are greater than 2000 feet and/or the landing visibility minimums are greater than 3 miles (Bishop, California; South Lake Tahoe, California; Ukiah, California; Butte, Montana; Helena, Montana; Missoula, Montana; Chadron, Nebraska; Ely, Nevada; Klamath Falls, Oregon; and Omak, Washington). In the case of these 10 airports, it is possible for a pilot to elect, on the basis of forecasts, not to carry sufficient fuel to get to an alternate when the ceiling and/or visibility is actually lower than that necessary to complete the approach.

(2) A small number of other airports in mountainous terrain have MDAs which are slightly (100 to 300 feet) below 2000 feet AGL. In situations where there is an option as to whether to plan for an alternate, pilots should bear in mind that just a slight worsening of the weather conditions from those forecast could place the airport below the published IFR landing minimums.

(3) An IFR flight to an airport which requires special equipment, i.e., DME, glide slope, etc., in order to make the available approaches to the lowest minimums. Pilots should be aware that all other minimums on the approach charts may require weather conditions better than those specified in FAR—91.23(b). An inflight equipment malfunction could result in the inability to comply with the published approach procedures or, again, in the position of having the airport below the published IFR landing minimums for all remaining instrument approach alternatives.

300. FLIGHTS OUTSIDE THE UNITED STATES AND U.S. TERRITORIES

a. When conducting flights, particularly extended flights, outside the U.S. and its territories, full account should be taken of the amount and quality of air navigation services available in the airspace to be traversed. Every effort should be made to secure information on the location and range of navigational aids, availability of communications and meterological services, the provision of air traffic services, including alerting service, and the existence of search and rescue services.

b. Pilots should remember that there is a need to continuously guard the VHF emergency frequency 121.5 MHz when on long over-water flights, except when communications on other VHF channels, equipment limitations, or cockpit duties prevent simultaneous guarding of two channels. Guarding of 121.5 MHz is particularly critical when operating in proximity to flight information region (FIR) boundaries, for example, operations on Route R220 between Anchorage and Tokyo, since it serves to facilitate communications with regard to aircraft which may experience in-flight emergencies, communications, or navigational difficulities. (Reference ICAO Annex 10, Vol II Paras 5.2.2.1.1.1 and 5.2.2.1.1.2.)

c. The filing of a flight plan, always good practice, takes on added significance for extended flights outside U.S. airspace and is, in fact, usually required by the laws of the countries being visited or overflown. It is also particularly important in the case of such flights that pilots leave a complete itinerary and schedule of the flight with someone directly concerned, keep that person advised of the flight's progress and inform him that if serious doubt arises as to the safety of the flight he should first contact the appropriate FSS.

d. All pilots should review the foreign airspace and entry restrictions published in the IFIM during the flight planning process. Foreign airspace penetration without official authorization can involve both danger to the aircraft and the imposition of severe penalties and inconvenience to both passengers and crew. A flight plan on file with ATC authorities does not necessarily constitute the prior permis-

sion required by certain other authorities. The possibility of fatal consequences cannot be ignored in some areas of the world.

e. Current NOTAMs for foreign locations must also be reviewed. The publication International Notices to Airmen, published biweekly, contains considerable information pertinent to foreign flight. Current foreign NOTAMs are also available from the U.S. International NOTAM Office in Washington, D.C., through any local FSS.

f. When customs notification is required, it is the responsibility of the pilot to arrange for customs notification in a timely manner. The following guidelines are applicable:

(1) When customs notification is required on flights to Canada and Mexico and a predeparture flight plan cannot be filed or an advise customs message (ADCUS) cannot be included in a predeparture flight plan, call the nearest en route domestic or International FSS as soon as radio communication can be established and file a VFR or DVFR flight plan, as required, and include as the last item the advise customs information. The station with which such a flight plan is filed will forward it to the appropriate FSS who will notify the customs office responsible for the destination airport.

(2) If the pilot fails to include ADCUS in the radioed flight plan, it will be assumed that other arrangements have been made and FAA will not advise customs.

(3) The FAA assumes no responsibility for any delays in advising customs if the flight plan is given too late for delivery to customs before arrival of the aircraft. It is still the pilot's responsibility to give timely notice even though a flight plan is given to FAA.

301. CHANGE IN FLIGHT PLAN

In addition to altitude or flight level, destination and/or route changes, increasing or decreasing the speed of an aircraft constitutes a change in a flight plan. Therefore, at any time the average true airspeed at cruising altitude between reporting points varies or is expected to vary from that given in the flight plan by *plus or minus 5 percent, or 10 knots, whichever is greater,* ATC should be advised.

302. CHANGE IN PROPOSED DEPARTURE TIME

a. To prevent computer saturation in the en route environment, parameters have been established to delete proposed departure flight plans which have not been activated. Most centers have this parameter set so as to delete these flight plans a minimum of 1 hour after the proposed departure time. To ensure that a flight plan remains active, pilots whose actual departure time will be delayed 1 hour or more beyond their filed departure time, are requested to notify ATC of their departure time.

b. Due to traffic saturation, control personnel frequently will be unable to accept these revisions via radio. It is recommended that you forward these revisions to the nearest FSS.

303. CLOSING VFR/DVFR FLIGHT PLANS

A pilot is responsible for ensuring that his VFR or DVFP flight plan is cancelled (FAR—91.83). You should close your flight plan with the nearest FSS, or if one is not available, you may request any ATC facility to relay your cancellation to the FSS. *Control towers do not automatically close VFR or DVFR flight plans* since they do not know if a particular VFR aircraft is on a flight plan. If you fail to report or cancel your flight plan within 1/2 hour after your ETA, Search and Rescue procedures are started.

304. CANCELLING IFR FLIGHT PLAN

a. FAR—91.83 includes the statement "When a flight plan has been filed, the pilot in command, upon cancelling or completing the flight under the flight plan, shall notify the nearest FSS or ATC facility."

b. An IFR flight plan may be cancelled at any time the flight is operating in VFR conditions outside positive controlled airspace by the pilot stating "CANCEL MY IFR FLIGHT PLAN" to the controller or air/ground station with which he is communicating. Immediately after cancelling an IFR flight plan, a pilot should take necessary action to change to the appropriate air/ground frequency, VFR radar beacon code and VFR altitude or flight level.

c. ATC separation and information services will be discontinued, including radar services (where applicable). Consequently, if the cancelling flight desires VFR radar advisory service, the pilot must specifically request it.

NOTE.— Pilots must be aware that other procedures may be applicable to a flight that cancels an IFR flight plan within an area where a special program has been established such as a designated TRSA or TCA.

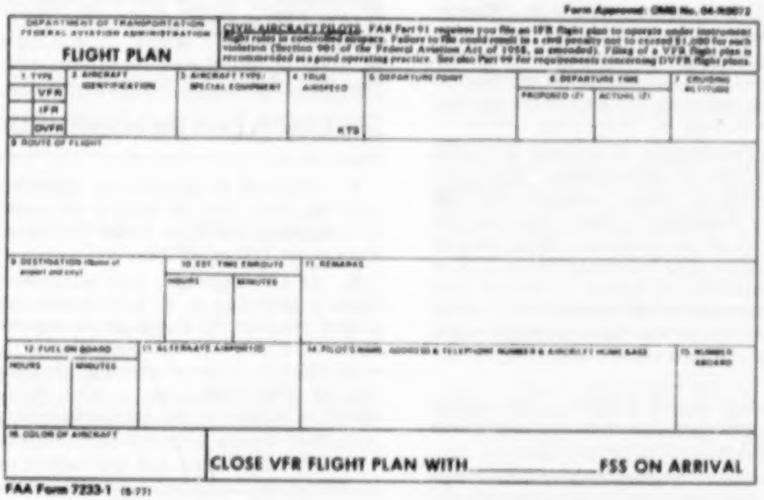
d. If a DVFR flight plan requirement exists, the pilot is responsible for filing this flight plan to replace the cancelled IFR flight plan. If a subsequent IFR operation becomes necessary, a new IFR flight plan must be filed and an ATC clearance obtained before operating in IFR conditions.

e. If operating on an IFR flight plan to an airport with a functioning control tower, the flight plan is automatically closed upon landing.

f. If operating on an IFR flight plan to an airport where there is no functioning control tower, the pilot must initiate cancellation of the IFR flight plan. This can be done after landing if there is a functioning FSS or other means of direct communications with ATC. In the event there is no FSS and air/ground communications with ATC is not possible below a certain altitude, the pilot should, weather conditions permitting, cancel his IFR flight plan while still airborne and able to communicate with ATC by radio. This will not only save the time and expense of cancelling the flight plan by telephone but will quickly release the airspace for use by other aircraft.

305. GENERAL INSTRUCTIONS FOR THE FAA FLIGHT PLAN FORM

a. Flight Plan Form.



Form Approved: OMB No. 04-R0072

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
FLIGHT PLAN

CIVIL AIRCRAFT PILOTS. FAR Part 91 requires you file an IFR flight plan to operate under instrument flight rules in controlled airspace. Failure to file could result in a civil penalty not to exceed $1,000 for each violation (Section 901 of the Federal Aviation Act of 1958, as amended). Filing of a VFR flight plan is recommended as a good operating practice. See also Part 99 for requirements concerning DVFR flight plans.

1 TYPE ☐ VFR ☐ IFR ☐ DVFR	2 AIRCRAFT IDENTIFICATION	3 AIRCRAFT TYPE/ SPECIAL EQUIPMENT	4 TRUE AIRSPEED KTS	5 DEPARTURE POINT	6 DEPARTURE TIME PROPOSED (Z)	ACTUAL (Z)	7 CRUISING ALTITUDE

8 ROUTE OF FLIGHT

9 DESTINATION (Name of airport and city)	10 EST. TIME ENROUTE HOURS	MINUTES	11 REMARKS

12 FUEL ON BOARD HOURS	MINUTES	13 ALTERNATE AIRPORT(S)	14 PILOT'S NAME, ADDRESS & TELEPHONE NUMBER & AIRCRAFT HOME BASE	15 NUMBER ABOARD

16 COLOR OF AIRCRAFT

CLOSE VFR FLIGHT PLAN WITH ____________ FSS ON ARRIVAL

FAA Form 7233-1 (8-77)

b. Explanation of Flight Plan Items.

Block 1. Check the type flight plan. Check both the VFR and IFR blocks if composite VFR/IFR.

Block 2. Enter your complete aircraft identification including the prefix "N" if applicable.

Block 3. Enter the designator for the aircraft or, if unknown, the aircraft manufacturer's name (e.g., Cessna); followed by a slant(/) and the transponder or DME equipment code letter (e.g., C-182/U).

Block 4. Enter your computed true airspeed (TAS).

NOTE.— If IFR and the average TAS changes plus or minus 5 percent or 10 knots, whichever is greater, advise ATC.

Block 5. Enter the departure airport identifier code (or the name if identifier is unknown).

NOTE.— Use of identifier codes will expedite the processing of your flight plan.

Block 6. Enter the proposed departure time in Coordinated Universal Time (UTC) (Z). If airborne, specify the actual or proposed departure time as appropriate.

Block 7. If VFR, enter the appropriate VFR altitude (to assist the briefer in providing weather and wind information) and, if IFR, enter the requested en route altitude or flight level.

NOTE.— Enter only the initial requested altitude in this block. When more than one IFR altitude or flight level is desired along the route of flight, it is best to make a subsequent request direct to the controller.

Block 8. Define the route of flight by using NAVAID identifier codes (or names if the code is unknown), airways, jet routes, and waypoints (for RNAV).

NOTE.— Use NAVAIDs or WAYPOINTs to define direct route and radials/bearings to define other unpublished routes.

Block 9. Enter the destination airport identifier code (or name if identifier is unknown).

NOTE.— Include the city name (or even the state name) if needed for clarity.

Block 10. Enter your estimated time en route based on latest forecast winds.

Block 11. Enter only those remarks pertinent to ATC or to the clarification of other flight plan information such as the appropriate radiotelephony (call sign) associated with the designator filed in Block 2. Items of a personal nature are not accepted. Do not assume that remarks will be automatically transmitted to every controller. Specific ATC or en route requests should be made directly to the appropriate controller.

Block 12. Specify the fuel on board computed from the departure point.

Block 13. Specify an alternate airport if desired or required, but do not include routing to the alternate airport.

Block 14. Enter your complete name, address, and telephone number. Enter sufficient information to identify home base, airport, or operator.

NOTE.— This information would be essential in the event of search and rescue operation.

Block 15. Enter the total number of persons on board including crew.

Block 16. Enter the predominant colors.

Last Block. For VFR flight plans, record the FSS name for closing the flight plan. If the flight plan is closed with a different FSS or facility, state the recorded FSS name that would normally have closed your flight plan.

NOTE.— Close IFR flight plans with tower, approach control, or ARTCCs, or if unable, with FSS. When landing at an airport with a functioning control tower, IFR flight plans are automatically cancelled.

c. The information transmitted to the destination FSS for VFR Flight Plans will consist only of flight plans blocks 2,3,9, and 10. Estimated time en route (ETE) will be converted to the correct estimated time of arrival (ETA) for VFR flight plans.

d. The information transmitted to the ARTCC for IFR Flight Plans will consist of only flight plan blocks 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11.

e. A description of the International Flight Plan Form is contained in the International Flight Information Manual.

306—319. RESERVED

NOTES

Section 6. DEPARTURE PROCEDURES

320. PRE-TAXI CLEARANCE PROCEDURES

a. Certain airports have established Pre-taxi Clearance programs whereby pilots of departing IFR aircraft may elect to receive their IFR clearances before they start taxiing for takeoff. The following provisions are included in such procedures:

(1) Pilot participation is not mandatory.

(2) Participating pilots call clearance delivery or ground control not more than 10 minutes before proposed taxi time.

(3) IFR clearance (or delay information, if clearance cannot be obtained) is issued at the time of this initial call-up.

(4) When the IFR clearance is received on clearance delivery frequency, pilots call ground control when ready to taxi.

(5) Normally, pilots need not inform ground control that they have received IFR clearance on clearance delivery frequency. Certain locations may, however, require that the pilot inform ground control of a portion of his routing or that he has received his IFR clearance.

(6) If a pilot cannot establish contact on clearance delivery frequency or has not received his IFR clearance before he is ready to taxi, he contacts ground control and informs the controller accordingly.

b. Locations where these procedures are in effect are indicated in the Airport/Facility Directory.

321. TAXI CLEARANCE

Pilots on IFR flight plans should communicate with the control tower on the appropriate ground control or clearance delivery frequency, prior to starting engines, to receive engine start time, taxi and/or clearance information.

322. ABBREVIATED IFR DEPARTURE CLEARANCE (CLEARED...AS FILED) PROCEDURES

a. ATC facilities will issue an abbreviated IFR departure clearance based on the ROUTE of flight filed in the IFR flight plan, provided the filed route can be approved with little or no revision. These abbreviated clearance procedures are based on the following conditions:

(1) The aircraft is on the ground or it has departed VFR and the pilot is requesting IFR clearance while airborne.

(2) That a pilot will not accept an abbreviated clearance if the route or destination of a flight plan filed with ATC has been changed by him or the company or the operations officer before departure.

(3) That it is the responsibility of the company or operations office to inform the pilot when they make a change to the filed flight plan.

(4) That it is the responsibility of the pilot to inform ATC in his initial call-up (for clearance) when the filed flight plan has been either:

(a) amended, or

(b) cancelled and replaced with a new filed flight plan.

NOTE.— The facility issuing a clearance may not have received the revised route or the revised flight plan by the time a pilot requests clearance.

b. The controller will issue a detailed clearance when he knows that the original filed flight plan has been changed or when the pilot requests a full route clearance.

c. The clearance as issued will include the destination airport filed in the flight plan.

d. ATC procedures now require the controller to state the SID name, the current number and the SID Transition name after the phrase "Cleared to (destination) airport" and prior to the phrase, "then as filed," for ALL departure clearances when the SID or SID Transition is to be flown. The procedures apply whether or not the SID is filed in the flight plan.

e. STARs, when filed in a flight plan, are considered a part of the filed route of flight and will not normally be stated in an initial departure clearance. If the ARTCC's jurisdictional airspace includes both the departure airport and the fix where a STAR or STAR Transition begins, the STAR name, the current number and the STAR Transition name MAY be stated in the initial clearance.

f. "Cleared to (destination) airport as filed" does NOT include the en route altitude filed in a flight plan. An en route altitude will be stated in the clearance or the pilot will be advised to expect an assigned or filed altitude within a given time frame or at a certain point after departure. This may be done verbally in the departure instructions or stated in the SID.

g. In both radar and nonradar environments, the controller will state "Cleared to (destination) airport as filed" or:

(1) If a SID or SID Transition is to be flown, specify the SID name, the current SID number, the SID Transition name, the assigned altitude/flight level, and any additional instructions (departure control frequency, beacon code assignment, etc.) necessary to clear a departing aircraft via the SID or SID Transition and the route filed.

EXAMPLE:

NATIONAL SEVEN TWENTY CLEARED TO MIAMI AIRPORT INTERCONTINENTAL ONE DEPARTURE, LAKE CHARLES TRANSITION THEN AS FILED, MAINTAIN FLIGHT LEVEL TWO SEVEN ZERO.

(2) When there is no SID or when the pilot cannot accept a SID, the controller will specify the assigned altitude or flight level, and any additional instructions necessary to clear a departing aircraft via an appropriate departure routing and the route filed.

NOTE.— A detailed departure route description or a radar vector may be used to achieve the desired departure routing.

(3) If it is necessary to make a minor revision to the filed route, the controller will specify the assigned SID or SID Transition (or departure routing), the revision to the filed route, the assigned altitude or flight level and any additional instructions necessary to clear a departing aircraft.

EXAMPLE:

JET STAR ONE FOUR TWO FOUR CLEARED TO ATLANTA AIRPORT, SOUTH BOSTON TWO DEPARTURE THEN AS FILED EXCEPT CHANGE ROUTE TO READ SOUTH BOSTON VICTOR 20 GREENSBORO, MAINTAIN ONE SEVEN THOUSAND.

(4) Additionally, in a nonradar environment, the controller will specify one or more fixes, as necessary, to identify the initial route of flight.

EXAMPLE:

CESSNA THREE ONE SIX ZERO FOXTROT CLEARED TO CHARLOTTE AIRPORT AS FILED VIA BROOKE, MAINTAIN SEVEN THOUSAND.

h. To ensure success of the program, pilots should:

(1) Avoid making changes to a filed flight plan just prior to departure.

(2) State the following information in the initial call-up to the facility when no change has been made to the filed flight plan: Aircraft call sign, location, type operation (IFR) and the name of the airport (or fix) to which you expect clearance.

EXAMPLE:

"WASHINGTON CLEARANCE DELIVERY (or ground control if appropriate) AMERICAN SEVENTY SIX AT GATE ONE, IFR LOS ANGELES."

(3) If the flight plan has been changed, state the change and request a full route clearance.

EXAMPLE:

"WASHINGTON CLEARANCE DELIVERY, AMERICAN SEVENTY SIX AT GATE ONE. IFR SAN FRANCISCO. MY FLIGHT PLAN ROUTE HAS BEEN AMENDED (or destination changed). REQUEST FULL ROUTE CLEARANCE."

(4) Request verification or clarification from ATC if ANY portion of the clearance is not clearly understood.

(5) When requesting clearance for the IFR portion of a VFR/IFR flight, request such clearance prior to the fix where IFR operation is proposed to commence in sufficient time to avoid delay. Use the following phraseology:

EXAMPLE:

"LOS ANGELES CENTER, APACHE SIX ONE PAPA, VFR ESTIMATING PASO ROBLES VOR AT THREE TWO, ONE THOUSAND FIVE HUNDRED, REQUEST IFR TO BAKERSFIELD."

323. DEPARTURE RESTRICTIONS, CLEARANCE VOID TIMES, HOLD FOR RELEASE, AND RELEASE TIMES

a. ATC may assign departure restrictions, clearance void times, hold for release, and release times, when necessary, to separate departures from other traffic or to restrict or regulate the departure flow.

(1) CLEARANCE VOID TIMES — If operating from an airport not served by a control tower, the pilot may receive a clearance containing a provision that if the flight has not departed by a specific time, the clearance is void. In this situation, the pilot who does not depart prior to the void time must advise ATC as soon as possible, but no later than 30 minutes, of his intentions. Failure to take this action can result in costly delays and reroutes of other IFR traffic because ATC will take action on the assumption that the pilot departed as cleared. Additionally, extensive search and rescue operations may be initiated if nothing is heard from the pilot after he accepts the ATC clearance.

EXAMPLE:

CLEARANCE VOID IF NOT OFF BY (clearance void time) and, if required, IF NOT OFF BY (clearance void time) ADVISE (facility) NOT LATER THAN (time) OF INTENTIONS.

(2) HOLD FOR RELEASE — ATC may issue "hold for release" instructions in a clearance to delay an aircraft's departure for traffic management reasons (i.e., weather, traffic volume, etc.). When ATC states in the clearance, "hold for release," the pilot may not depart until he receives a release time or is given additional instructions by ATC. In addition, ATC will include departure delay information in conjunction with "hold for release" instructions.

EXAMPLE:

(aircraft identification) CLEARED TO (destination) AIRPORT AS FILED, MAINTAIN (altitude), and, if required (additional instructions or information), HOLD FOR RELEASE, EXPECT (time in hours and/or minutes) DEPARTURE DELAY.

(3) RELEASE TIMES — A "release time" is a departure restriction issued to a pilot by ATC, specifying the earliest time an aircraft may depart. ATC will use "release times" in conjunction with traffic management procedures and/or to separate a departing aircraft from other traffic.

EXAMPLE:

(aircraft identification) RELEASED FOR DEPARTURE AT (time in hours and/or minutes).

324. DEPARTURE CONTROL

a. Departure Control is an approach control function responsible for ensuring separation between departures. So as to expedite the handling of departures, Departure Control may suggest a take off direction other than that which may normally have been used under VFR handling. Many times it is preferred to offer the pilot a runway that will require the fewest turns after take off to place the pilot on his filed course or selected departure route as quickly as possible. At many locations particular attention is paid to the use of preferential runways for local noise abatement programs, and route departures away from congested areas.

b. Departure Control utilizing radar will normally clear aircraft out of the terminal area using SIDs via radio navigation aids. When a departure is to be vectored immediately following take off, the pilot will be advised prior to take off of the initial heading to be flown but may not be advised of the purpose of the heading. Pilots operating in a radar environment are expected to associate departure headings with vectors to their planned route or flight. When given a vector taking his aircraft off a previously assigned nonradar route, the pilot will be advised briefly what the vector is to achieve. Thereafter, radar service will be provided until the aircraft has been reestablished "on-course" using an appropriate navigation aid and the pilot has been advised of his position or a handoff is made to another radar controller with further surveillance capabilities.

c. Controllers will inform pilots of the departure control frequencies and, if appropriate, the transponder code before takeoff. Pilots should not operate their transponder until ready to start the takeoff roll or change to the departure control frequency until requested. Controllers may omit the departure control frequency if a SID has or will be assigned and the departure control frequency is published on the SID.

325. INSTRUMENT DEPARTURES

a. STANDARD INSTRUMENT DEPARTURES (SID)

(1) A SID is an ATC coded departure procedure which has been established at certain airports to simplify clearance delivery procedures.

(2) Pilots of civil aircraft operating from locations where SID procedures are effective may expect ATC clearances containing a SID. Use of a SID requires pilot possession of at least the textual description of the SID procedures. Controllers may omit the departure control frequency if a SID clearance is issued and the departure control frequency is published on the SID. If the pilot does not possess a charted SID or a preprinted SID description or, for any other reason, does not wish to use a SID, he is expected to advise ATC. Notification may be accomplished by filing "NO SID" in the remarks section of the filed flight plan or by the less desirable method of verbally advising ATC.

(3) All effective SIDs are published in textual and graphic form by the National Ocean Service in East and West SID booklets.

(4) SID procedures will be depicted in one of two basic forms.

(a) Pilot Navigation (Pilot NAV) SIDs: are established where the pilot is primarily responsible for navigation on the SID route. They are established for airports when terrain and safety related factors indicate the necessity for a pilot NAV SID. Some pilot NAV SIDs may contain vector instructions which pilots are expected to comply with until instruction are received to resume normal navigation on the filed/assigned route or SID procedure.

(b) Vector SIDs: are established where ATC will provide radar navigational guidance to a filed/assigned route or to a fix depicted on the SID.

b. OBSTRUCTION CLEARANCE DURING DEPARTURE

(1) Published instrument departure procedures and SIDs assist pilots conducting IFR flight in avoiding obstacles during climbout to minimum en route altitude (MEA). Standard instrument takeoff minimums and departure procedures are prescribed in FAR 91.116(f). Airports with takeoff minimums other than standard (one statute mile for aircraft having two engines or less and one-half statute mile for aircraft having more than two engines) are described in airport listings on separate pages, titled IFR TAKE-OFF MINIMUMS AND DEPARTURE PROCEDURES, at the front of each IAP book. The approach chart and SID chart for each airport with nonstandard takeoff minimums is annotated with a special symbol ▽. The use of this symbol indicates that the separate listing should be consulted. These minimums also apply to SIDs unless the SIDs specify different minimums.

(2) Obstacle clearance is based on the aircraft climbing at 200 feet per nautical mile, crossing the end of the runway at 35 feet AGL, and climbing to 400 feet above airport elevation before turning unless otherwise specified in the procedure. A slope of 152 feet per mile, starting no higher than 35 feet above the departure end of the runway, is assessed for obstacles. A minimum of 48 feet of obstacle clearance is provided for each mile of flight.

(a) If no obstacles penetrate the 152 feet per mile slope, IFR departure procedures are not published.

(b) If obstacles penetrate the slope, obstacle avoidance procedures are specified. These procedures may be: a ceiling and visibility to allow the obstacles to be seen and avoided; a climb gradient greater than 200 feet per mile; detailed flight maneuvers; or a combination of the above. In extreme cases, IFR takeoff may not be authorized for some runways.

EXAMPLE:

Rwy 17, 300-1 or standard with minimum climb of 220 feet per NM to 1100.

(3) Climb gradients are specified when required for obstacle clearance. Crossing restrictions in the SIDs may be established for traffic separation or obstacle clearance. When no gradient is specified, the pilot is expected to climb at least 200 feet per mile to MEA unless required to level off by a crossing restriction.

EXAMPLE:

"CROSS ALPHA INTERSECTION AT OR BELOW 4000; MAINTAIN 6000." The pilot climbs at least 200 feet per mile to 6000. If 4000 is reached before ALPHA, the pilot levels off at 4000 until passing ALPHA; then immediately resumes at least 200 feet per mile climb.

(4) Climb gradients may be specified to an altitude/fix, above which the normal gradient applies.

EXAMPLE:

"MINIMUM CLIMB 340 FEET PER NM TO 2700." The pilot climbs at least 340 feet per mile to 2700, then at least 200 feet per mile to MEA.

(5) Some procedures require a climb in visual conditions to cross the airport (or an on-airport NAVAID) at or above an altitude.

EXAMPLE:

"CLIMB VISUALLY TO CROSS THE AIRPORT AT OR ABOVE 8800, THEN CLIMB VIA R-293 TO ABC VOR."

(a) The specified ceiling and visibility minimums will be enough to allow the pilot to see and avoid obstacles near the airport. Obstacle avoidance is not guaranteed if the pilot maneuvers farther from the airport than the visibility minimum.

(b) That segment of the procedure which requires the pilot to see and avoid obstacles ends when the aircraft crosses the specified point at the required altitude. Thereafter, standard obstacle protection is provided.

(6) Each pilot, prior to departing an airport on an IFR flight should consider the type of terrain and other obstacles on or in the vicinity of the departure airport and:

(a) Determine whether a departure procedure and/or SID is available for obstacle avoidance.

(b) Determine if obstacle avoidance can be maintained visually or that the departure procedure or SID should be followed.

(c) Determine what action will be necessary and take such action that will assure a safe departure.

326—339. RESERVED

Section 7. EN ROUTE PROCEDURES

340. ARTCC COMMUNICATIONS

a. DIRECT COMMUNICATIONS — CONTROLLERS AND PILOTS

(1) ARTCCs are capable of direct communications with IFR air traffic on certain frequencies. Maximum communications coverage is possible through the use of Remote Center Air/Ground (RCAG) sites comprised of both VHF and UHF transmitters and receivers. These sites are located throughout the U.S.. Although they may be several hundred miles away from the ARTCC, they are remoted to the various ARTCCs by land lines or microwave links. Since IFR operations are expedited through the use of direct communications, pilots are requested to use these frequencies strictly for communications pertinent to the control of IFR aircraft. Flight plan filing, en route weather, weather forecasts and similar data should be requested through FSSs, company radio, or appropriate military facilities capable of performing these services.

(2) An ARTCC is divided into sectors. Each sector is handled by one or a team of controllers and has its own sector discrete frequency. As a flight progresses from one sector to another, the pilot is requested to change to the appropriate sector discrete frequency.

(3) ATC Frequency Change Procedures:

(a) The following phraseology will be used by controllers to effect a frequency change:

EXAMPLE:

(Aircraft Identification) CONTACT (facility name or location name and terminal function) (frequency) AT (time, fix or altitude).

NOTE.— Pilots are expected to maintain a listening watch on the transferring controller's frequency until the time, fix or altitude specified. ATC will omit frequency change restrictions whenever pilot compliance is expected upon receipt.

(b) The following phraseology should be utilized by pilots for establishing contact with the designated facility:

1. When a position report will be made:

EXAMPLE:

(Name) CENTER, (aircraft identification), (position).

2. When no position report will be made:

EXAMPLE:

(Name) CENTER, (aircraft identification), ESTIMATING (reporting point and time) AT (altitude or flight level) CLIMBING (or descending) TO MAINTAIN (altitude or flight level).

3. When operating in a radar environment and no position report is required:

EXAMPLE:

(Name) CENTER, (aircraft identification) AT (exact altitude or flight level); or, if appropriate,

EXAMPLE:

LEAVING (exact altitude or flight level) CLIMBING (or descending) TO MAINTAIN (altitude or flight level).

NOTE.— Exact altitude or flight level means to the nearest 100 foot increment. Exact altitude or flight level reports on initial contact provide ATC with information required prior to using MODE C altitude information for separation purposes.

(c) At times controllers will ask pilots to verify that they are at a particular altitude. The phraseology used will be: "VERIFY AT (altitude)." In climbing or descending situations, controllers may ask pilots to "VERIFY ASSIGNED ALTITUDE AS (altitude)." Pilots should confirm that they are at the altitude stated by the controller or that the assigned altitude is correct as stated. If this is not the case, they should inform the controller of the actual altitude being maintained or the different assigned altitude.

> *CAUTION:* Pilots should not take action to change their actual altitude or different assigned altitude to the altitude stated in the controllers verification request unless the controller specifically authorizes a change.

(4) ARTCC Radio Frequency Outage:

(a) ARTCCs normally have at least one back up radio receiver and transmitter system for each frequency which can usually be placed into service quickly with little or no disruption of ATC service. Occasionally, technical problems may cause a delay but switchover seldom takes more than 60 seconds. When it appears that the outage will not be quickly remedied, the ARTCC will usually request a nearby aircraft, if there is one, to switch to the affected frequency to broadcast communications instructions. It is important, therefore, that the pilot wait at least 1 minute before deciding that the ARTCC has actually experienced a radio frequency failure. When such an outage does occur, the pilot should, if workload and equipment capability permit, maintain a listening watch on the affected frequency while attempting to comply with the following recommended communications procedures:

1. If two-way communications cannot be established with the ARTCC after changing frequencies, a pilot should attempt to recontact the transferring controller for the assignment of an alternative frequency or other instructions.

2. When an ARTCC radio frequency failure occurs after two-way communications have been established, the pilot should attempt to reestablish contact with the center on any other known ARTCC frequency, preferably that of the next responsible sector when practicable, and ask for instructions. However, when the next normal frequency change along the route is known to involve another ATC facility, the pilot should contact that facility, if feasible, for instructions. If communications cannot be reestablished by either method, the pilot is expected to request communications instructions from the FSS appropriate to the route of flight.

NOTE.— The exchange of information between an aircraft and an ARTCC through an FSS is quicker than relay via company radio because the FSS has direct interphone lines to the responsible ARTCC sector. Accordingly, when circumstances dictate a

choice between the two, during an ARTCC frequency outage, relay via FSS radio is recommended.

341. POSITION REPORTING

The safety and effectiveness of traffic control depends to a large extent on accurate position reporting. In order to provide the proper separation and expedite aircraft movements, ATC must be able to make accurate estimates of the progress of every aircraft operating on an IFR flight plan.

a. POSITION IDENTIFICATION

(1) When a position report is to be made passing a VOR radio facility, the time reported should be the time at which the first complete reversal of the "to/from" indicator is accomplished.

(2) When a position report is made passing a facility by means of an airborne ADF, the time reported should be the time at which the indicator makes a complete reversal.

(3) When an aural or a light panel indication is used to determine the time passing a reporting point, such as a fan marker, Z marker, cone of silence or intersection of range courses, the time should be noted when the signal is first received and again when it ceases. The mean of these two times should then be taken as the actual time over the fix.

(4) If a position is given with respect to distance and direction from a reporting point, the distance and direction should be computed as accurately as possible.

(5) Except for terminal area transition purposes, position reports or navigation with reference to aids not established for use in the structure in which flight is being conducted will not normally be required by ATC.

b. POSITION REPORTING POINTS

(1) FARs require pilots to maintain a listening watch on the appropriate frequency and, unless operating under the provisions of (c), to furnish position reports passing certain reporting points. Reporting points are indicated by symbols on en route charts. The designated compulsory reporting point symbol is a solid triangle and the "on request" reporting point symbol is the open triangle. Reports passing an "on request" reporting point are only necessary when requested by ATC.

c. POSITION REPORTING REQUIREMENTS

(1) **Flights along airways or routes —** A position report is required by all flights regardless of altitude, including those operating in accordance with an ATC clearance specifying "VFR ON TOP," over each designated compulsory reporting point along the route being flown.

(2) **Flight Along a Direct Route —** Regardless of the altitude or flight level being flown, including flights operating in accordance with an ATC clearance specifying "VFR ON TOP", pilots shall report over each reporting point used in the flight plan to define the route of flight.

(3) **Flights in a Radar Environment —** When informed by ATC that their aircraft are in "RADAR CONTACT," PILOTS SHOULD DISCONTINUE POSITION REPORTS OVER DESIGNATED REPORTING POINTS. They should resume normal position reporting when ATC advises "RADAR CONTACT LOST" or "RADAR SERVICE TERMINATED."

NOTE.— ATC will inform a pilot that he is in "RADAR CONTACT" (a) when his aircraft is initially identified in the ATC system; and (b) when radar identification is reestablished after radar service has been terminated or radar contact lost. Subsequent to being advised that the controller has established radar contact, this fact will not be repeated to the pilot when handed off to another controller. At times, the aircraft identity will be *confirmed* by the receiving controller; however, this should not be construed to mean that radar contact has been lost. The identity of transponder equipped aircraft will be confirmed by asking the pilot to "IDENT," "SQUAWK STANDBY," or to change codes. Aircraft without transponders will be advised of their position to confirm identity. In this case, *the pilot is expected to advise the controller if he disagrees with the position given.* If the pilot cannot confirm the accuracy of the position given because he is not tuned to the NAVAID referenced by the controller, the pilot should ask for another radar position relative to the NAVAID to which he is tuned.

d. POSITION REPORT ITEMS

(1) Position reports should include the following items:

(a) Identification.

(b) Position.

(c) Time.

(d) Altitude or flight level (include actual altitude or flight level when operating on a clearance specifying VFR ON TOP.)

(e) Type of flight plan (not required in IFR position reports made directly to ARTCCs or approach control),

(f) ETA and name of next reporting point.

(g) The name only of the next succeeding reporting point along the route of flight, and

(h) Pertinent remarks.

342. ADDITIONAL REPORTS

a. The following reports should be made to ATC or FSS facilities without a specific ATC request:

(1) *At all times:*

(a) When vacating any previously assigned altitude or flight level for a newly assigned altitude or flight level.

(b) When an altitude change will be made if operating on a clearance specifying VFR ON TOP.

(c) When *unable* to climb/descend at a rate of at least 500 feet per minute.

(d) When approach has been missed. (Request clearance for specific action; i.e., to alternative airport, another approach, etc.)

(e) Change in the average true airspeed (at cruising altitude) when it varies by 5 percent or 10 knots (whichever is greater) from that filed in the flight plan.

(f) The time and altitude or flight level upon reaching a holding fix or point to which cleared.

(g) When leaving any assigned holding fix or point.

NOTE.— The reports in subparagraphs (f) and (g) may be omitted by pilots of aircraft involved in instrument training at military terminal area facilities when radar service is being provided.

(h) Any loss, in controlled airspace, of VOR, TACAN, ADF, low frequency navigation receiver capability, complete or partial loss of ILS receiver capability or impairment of air/ground communications capability.

(l) Any information relating to the safety of flight.

(2) *When not in radar contact:*

(a) When leaving final approach fix inbound on final approach (non precision approach) or when leaving the outer marker or fix used in lieu of the outer marker inbound on final approach (precision approach).

(b) A corrected estimate at anytime it becomes apparent that an estimate as previously submitted is in error in excess of 3 minutes.

b. Pilots encountering weather conditions which have not been forecast, or hazardous conditions which have been forecast, are expected to forward a report of such weather to ATC. (See PARA—520 - PILOT WEATHER REPORTS (PIREPs) and FAR—91.125(b) and (c).)

343. AIRWAYS AND ROUTE SYSTEMS

a. Two fixed route systems are established for air navigation purposes. They are the VOR and L/MF system, and the jet route system. To the extent possible, these route systems are aligned in an overlying manner to facilitate transition between each.

(1) The VOR and L/MF Airway System consists of airways designated from 1,200 feet above the surface (or in some instances higher) up to but not including 18,000 feet MSL. These airways are depicted on En Route Low Altitude Charts.

(a) THE VOR AIRWAYS are predicated solely on VOR or VORTAC navigation aids, except in Alaska, and are depicted in blue on aeronautical charts and are identified by a "V" (Victor) followed by the airway number (e.g., V12).

NOTE.— Segments of VOR airways in Alaska are based on L/MF navigation aids and charted in brown color instead of blue on en route charts.

1. A segment of an airway which is common to two or more routes carries the numbers of all the airways which coincide for that segment. When such is the case, a pilot filing a flight plan needs to indicate only that airway number of the route which he is using.

2. *Alternate Airways* are identified by their location with respect to the associated main airway. "Victor 9 West" indicates an alternate airway associated with, and lying to the west of Victor 9.

NOTE.— A pilot who intends to make an airway flight, using VOR facilities, will simply specify the appropriate "Victor" airway(s) in his flight plan. For example, if a flight is to be made from Chicago to New Orleans at 8,000 feet, using omniranges only, the route may be indicated as "Departing from Chicago-Midway, cruising 8,000 feet via Victor 9 to Moisant International." If flight is to be conducted in part by means of L/MF navigation aids and in part on omniranges, specifications of the appropriate airways in the flight plan will indicate which types of facilities will be used along the described routes, and, for IFR flight, permit ATC to issue a traffic clearance accordingly. A route may also be described by specifying the station over which the flight will pass, but in this case since many VOR's and L/MF aids have the same name, the pilot must be careful to indicate which aid will be used at a particular location. This will be indicated in the route of flight portion of the flight plan by specifying the type of facility to be used after the location name in the following manner: Newark L/MF, Allentown VOR.

3. With respect to position reporting, reporting points are designated for VOR Airway Systems. Flights using Victor Airways will report over these points unless advised otherwise by ATC.

(b) THE L/MF AIRWAYS (colored airways) are predicated solely on L/MF navigation aids and are depicted in brown on aeronautical charts and are identified by color name and number (e.g., Amber One). Green and Red airways are plotted east and west. Amber and Blue airways are plotted north and south.

NOTE.— The colored airway system exists only in the State of Alaska. All such airways formerly designated within the conterminous U.S. have been rescinded.

(2) THE JET ROUTE SYSTEM consists of jet routes established from 18,000 feet MSL to FL 450 inclusive.

(a) These routes are depicted on En Route High Altitude Charts. Jet routes are depicted in blue on aeronautical charts and are identified by a "J" (Jet) followed by the airway number (e.g., J 12). Jet routes, as VOR airways, are predicated solely on VOR or VORTAC navigation facilities (except in Alaska).

NOTE.— Segments of jet routes in Alaska are based on L/MF navigation aids and are charted in brown color instead of blue on en route charts.

(b) With respect to position reporting, reporting points are designated for Jet Route systems. Flights using Jet Routes will report over these points unless otherwise advised by ATC.

(3) AREA NAVIGATION (RNAV) ROUTES

(a) RNAV is a method of navigation that permits aircraft operations on any desired course within the coverage of station referenced navigation signals or within the limits of a self-contained system capability or combination of these.

(b) Fixed RNAV routes are permanent, published routes which can be flight planned for use by aircraft with RNAV capability. A previously established fixed RNAV route system has been terminated except for a few high altitude routes in Alaska.

(c) Random RNAV routes are direct routes, based on area navigation capability, between waypoints defined in terms of latitude/longitude coordinates, degree-distance fixes, or offsets from established routes/airways at a specified distance and direction. Radar monitoring by ATC is required on all random RNAV routes.

b. OPERATION ABOVE FL 450 may be conducted on a point-to-point basis. Navigational guidance is provided on an area basis utilizing those facilities depicted on the En Route High Altitude Charts.

c. **Radar Vectors.** Controllers may vector aircraft within controlled airspace for separation purposes, noise abatement considerations, when an operational advantage will be realized by the pilot or the controller, or when requested by the pilot. Vectors outside of controlled airspace will be provided only on pilot request. Pilots will be advised as to what the vector is to achieve when the vector is controller initiated and will take the aircraft off a previously assigned nonradar route. To the extent possible, aircraft operating on RNAV routes will be allowed to remain on their own navigation.

d. **Pilots are cautioned when flying in Canadian airspace, to review Canadian Air Regulations.**

(1) Special attention should be given to the parts which differ from U.S. FARs.

(a) The Canadian Airways CLASS B airspace restriction is an example. CLASS B airspace is all controlled low level airspace above 12,500 feet MSL or the MEA, whichever is higher, within which only IFR and controlled VFR flights are permitted. (Low level airspace means an airspace designated and defined as such in the *Designated Airspace Handbook.)*

(b) Regardless of the weather conditions or the height of the terrain, no person shall operate an aircraft under VFR conditions within CLASS B airspace except in accordance with a clearance for VFR flight issued by ATC.

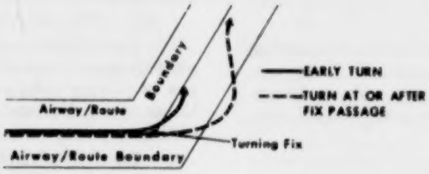
(c) Unless otherwise authorized by the Director General, Civil Aeronautics of the Department of Transportation, no person holding a commercial or private pilot license without an instrument rating shall operate an aircraft in VFR flight within CLASS B airspace unless successful completion of a written examination demonstrating knowledge of radio navigation and of ATC procedures applicable to IFR flight including clearances and position reports is accomplished. The pilot license must be endorsed to that effect.

(2) Segments of VOR airways and high level routes in Canada are based on L/MF navigation aids and are charted in brown color instead of blue on en route charts.

344. AIRWAY OR ROUTE COURSE CHANGES

a. Pilots of aircraft are required to adhere to airways or routes being flown. Special attention must be given to this requirement during course changes. Each course change consists of variables that make the technique applicable in each case a matter only the pilot can resolve. Some variables which must be considered are turn radius, wind effect, airspeed, degree of turn, and cockpit instrumentation. An early turn, as illustrated below, is one method of adhering to airways or routes. The use of any available cockpit instrumentation, such as distance measuring equipment, may be used by the pilot to lead his turn when making course changes. This *is consistent* with the intent of FAR-91.123, which requires pilots to operate along the centerline of an airway and along the direct course between navigational aids or fixes.

b. Turns which begin at or after fix passage may exceed airway or route boundaries. The following illustration contains an example flight track depicting this, together with an example of an early turn.



c. Without such actions as leading a turn, aircraft operating in excess of 290 knots TAS can exceed the normal airway or route boundaries depending on the amount of course change required, wind direction and velocity, the character of the turn fix (DME, overhead navigation aid, or intersection), and the pilot's technique in making a course change. For example, a flight operating at 17,000 feet MSL with a TAS of 400 knots, a 25 degree bank, and a course change of more than 40 degrees would exceed the width of the airway or route; i.e., 4 nautical miles each side of centerline. However, in the airspace below 18,000 feet MSL, operations in excess of 290 knots TAS are not prevalent and the provision of additional IFR separation in all course change situations for the occasional aircraft making a turn in excess of 290 knots TAS creates an unacceptable waste of airspace and imposes a penalty upon the preponderance of traffic which operate at low speeds. Consequently, the FAA expects pilots to lead turns and take other actions they consider necessary during course changes to adhere as closely as possible to the airways or route being flown.

d. Due to the high airspeeds used at 18,000 feet MSL and above, FAA provides additional IFR separation protection for course changes made at such altitude levels.

345. CHANGEOVER POINTS (COP)

a. COPs are prescribed for federal airways, jet routes, area navigation routes, or other direct routes for which an MEA is designated under FAR—95. The COP is a point along the route or airway segment between two adjacent navigation facilities or way points where changeover in navigation guidance should occur. At this point, the pilot should change navigation receiver frequency from the station behind the aircraft to the station ahead.

b. The COP is located midway between the navigation facilities for straight route segments, or at the intersection of radials or courses forming a dogleg in the case of dogleg route segments. When the COP is NOT located at the midway point, aeronautical charts will depict the COP location and give the mileage to the radio aids.

c. COPs are established for the purpose of preventing loss of navigation guidance, to prevent frequency interference from other facilities, and to prevent use of different facilities by different aircraft in the same airspace. Pilots are urged to observe COPs to the fullest extent.

346. RESERVED

347. HOLDING

a. Whenever an aircraft is cleared to a fix other than the destination airport and delay is expected, it is the responsibility of the ATC controller to issue complete holding instructions (unless the pattern is charted), * an EFC time and his best estimate of any additional en route/terminal delay.

b. If the holding pattern is charted and the controller doesn't issue complete holding instructions, the pilot is expected to hold as depicted on the appropriate chart. When the pattern is charted, the controller may omit all holding instructions except the charted holding direction and the statement *AS PUBLISHED* e.g., *HOLD EAST AS PUBLISHED.* Controllers shall always issue complete holding instructions when pilots request them.

NOTE.—* Only those holding patterns depicted on U.S. Government or commercially produced (meeting FAA requirements) *Low/High Altitude En route, and Area or STAR* charts should be used.

c. If no holding pattern is charted and holding instructions have not been issued, the pilot should ask ATC for holding instructions prior to reaching the fix. This procedure will eliminate the possibility of an aircraft entering a holding pattern other than that desired by ATC. If the pilot is unable to obtain holding instructions prior to reaching the fix (due to frequency congestion, stuck microphone, etc.), he should hold in a standard pattern on the course on which he approached the fix and request further clearance as soon as possible. In this event, the altitude/flight level of the aircraft at the clearance limit will be protected so that separation will be provided as required.

d. When an aircraft is 3 minutes or less from a clearance limit and a clearance beyond the fix has not been received, the pilot is expected to start a speed reduction so that he will cross the fix, initially, at or below the maximum holding airspeed.

e. When no delay is expected, the controller should issue a clearance beyond the fix as soon as possible and, whenever possible, at least 5 minutes before the aircraft reaches the clearance limit.

f. Pilots should report to ATC the time and altitude/flight level at which the aircraft reaches the clearance limit and report leaving the clearance limit.

NOTE.— In the event of two-way communications failure, pilots are required to comply with FAR 91.127.

g. When holding at a VOR station, pilots should begin the turn to the outbound leg at the time of the first complete reversal of the to/from indicator.

h. Patterns at the most generally used holding fixes are depicted (charted) on U.S. Government or commercially produced (meeting FAA requirements) Low or High Altitude En route, Area and STAR Charts. Pilots are expected to hold in the pattern depicted unless specifically advised otherwise by ATC.

i. An ATC clearance requiring an aircraft to hold at a fix where the pattern is not charted will include the following information:

(1) Direction of holding from the fix in terms of the eight cardinal compass points (i.e., N, NE, E, SE, etc.).

(2) Holding fix (the fix may be omitted if included at the beginning of the transmission as the clearance limit).

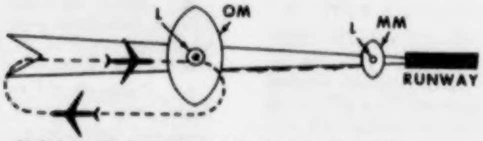
(3) Radial, course, bearing, airway or route on which the aircraft is to hold.

(4) Leg length in miles if DME or RNAV is to be used (leg length will be specified in minutes on pilot request or if the controller considers it necessary).

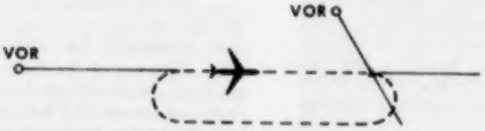
(5) Direction of turn if left turns are to be made, the pilot requests, or the controller considers it necessary.

(6) Time to expect further clearance and any pertinent additional delay information.

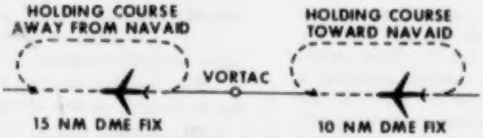
EXAMPLES OF HOLDING


L
OM
L
MM
RUNWAY

TYPICAL PROCEDURE ON AN ILS OUTER MARKER



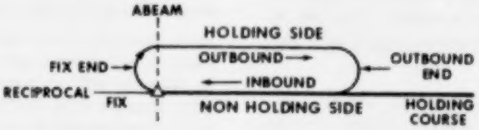
TYPICAL PROCEDURE AT INTERSECTION OF VOR RADIALS


HOLDING COURSE AWAY FROM NAVAID
HOLDING COURSE TOWARD NAVAID
VORTAC
15 NM DME FIX
10 NM DME FIX

TYPICAL PROCEDURE AT DME FIX

j. Holding pattern airspace protection is based on the following procedures. They are the only procedures for entry and holding recommended by FAA.

(1) Descriptive Terms


ABEAM
HOLDING SIDE
OUTBOUND
INBOUND
FIX END
OUTBOUND END
RECIPROCAL
FIX
NON HOLDING SIDE
HOLDING COURSE

(a) Standard Pattern : Right turns (illustrated)

(b) Nonstandard Pattern : Left turns

(2) Airspeeds (maximum)

(a) Propeller-driven	
1. All (including turboprop)	175K IAS
(b) Civil turbojet	
1. MHA through 6,000 feet	200K IAS
2. Above 6,000 feet through 14,000 feet	210K IAS
3. Above 14,000 feet	230K IAS
(c) Military turbojet	
1. All-except aircraft listed below	230K IAS
2. F-84F, F-100, F-102, F-104, F-106, T-38, F-4, F-8, F-11, F-14, F-15, F-16, A-5, A-7 (USAF only), AV-8	265K IAS
3. F-4 (USAF only)	280K IAS
4. F-100, F/RF-101, F-104, F-105, F-111, SR-71	310K IAS
5. T-37	175K IAS

NOTE.— Holding speed depends upon weight and drag configuration.

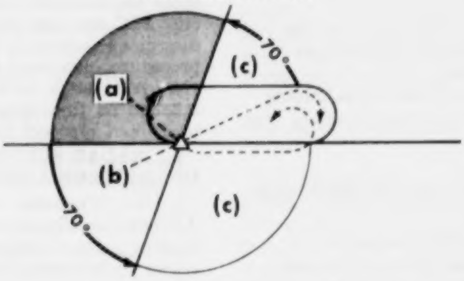
(3) Entry

(a) Parallel Procedure — Parallel holding course, turn left, and return to holding fix or intercept holding course.

(b) Teardrop Procedure — Proceed on outbound track of 30 degrees (or less) to holding course, turn right to intercept holding course.

(c) Direct Entry Procedure — Turn right and fly the pattern.

STANDARD PATTERN



(4) Timing:

(a) Inbound Leg

1. At/below 14,000 Ft. MSL - 1 minute.
2. Above 14,000 Ft. MSL - 1 and 1/2 minute.

NOTE.— The *initial* outbound leg should be flown for 1 minute or 1 and 1/2 min. (appropriate to altitude). Timing for subsequent outbound legs should be adjusted as necessary to achieve proper inbound leg time. Pilots may use any navigational means available (i.e. DME, RNAV, etc.) to insure the appropriate inbound leg times.

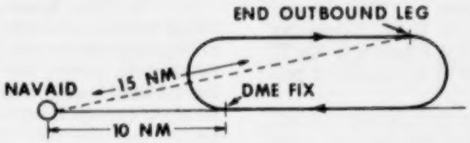
(b) Outbound leg timing begins *over / abeam* the fix, whichever occurs later. If the *abeam* position cannot be determined, start timing when turn to outbound is completed.

(5) Distance Measuring Equipment (DME)

(a) DME holding is subject to the same entry and holding procedures except that distances (nautical miles) are used in lieu of time values. The *outbound course* of a DME holding pattern is called the outbound leg of the pattern. The length of the outbound leg will be specified by the controller. The end of the outbound leg is determined by the odometer reading.

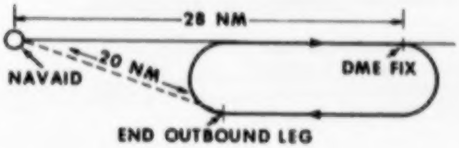
EXAMPLE:

When the inbound course is *toward* the NAVAID and the fix distance is 10 NM, and the leg length is 5NM, then the end of the outbound leg will be reached when the DME reads 15 NM.



EXAMPLE:

When the inbound course is *away* from the NAVAID and the fix distance is 28 NM and the leg length is 8 NM, then the end of the outbound leg will be reached when the DME reads 20 NM.



(6) Pilot Action

(a) Start speed reduction when 3 minutes or less from the holding fix. Cross the holding fix, initially, at or below the maximum holding airspeed.

(b) Make all turns during entry and while holding at:

1. 3 degrees per second, or
2. 30 degree bank angle, or
3. 25 degree bank provided a flight director system is used.

NOTE.— Use whichever requires the least bank angle.

(c) Compensate for wind effect primarily by drift correction on the inbound and outbound legs. When outbound, double the (inbound) drift correction to avoid major turning adjustments; e.g., if correcting left by 8 degrees when inbound, correct right by 16 degrees when outbound.

(d) Determine entry turn from aircraft heading upon arrival at the holding fix. Plus/minus 5 degrees in heading is considered to be within allowable good operating limits for determining entry.

(e) Advise ATC immediately if any increased airspeed is necessary due to turbulence, icing, etc., or if unable to accomplish any part of the holding procedures. When such higher speeds become no longer necessary, operate according to the appropriate published holding speed and notify ATC.

NOTE.— Airspace protection for turbulent air holding is based on a maximum of 280K IAS/Mach 0.8, whichever is lower. Considerable impact on traffic flow will result when turbulent air holding patterns are used; thus, pilot discretion will ensure their use is limited to bona fide conditions or requirements.

(7) Nonstandard Holding Pattern — Fix end and outbound end turns are made to the left. Entry procedures to a nonstandard pattern are oriented in relation to the 70 degree line on the holding side just as in the standard pattern.

k. When holding at a fix and instructions are received specifying the time of departure from the fix, the pilot should adjust his flight path within the limits of the established holding pattern in order to leave the fix at the exact time specified. After departing the holding fix, normal speed is to be resumed with respect to other governing speed requirements such as terminal area speed limits, specific ATC requests, etc. Where the fix is associated with an instrument approach, and timed approaches are in effect, a procedure turn shall not be executed unless the pilot advises ATC, since aircraft holding are expected to proceed inbound on final approach directly from the holding pattern when approach clearance is received.

l. RADAR SURVEILLANCE OF OUTER FIX HOLDING PATTERN AIRSPACE AREAS.

(1) Whenever aircraft are holding at an outer fix, ATC will usually provide radar surveillance of the outer fix holding pattern airspace area, or any portion of it, if it is shown on the controller's radar scope.

(2) The controller will attempt to detect any holding aircraft that stray outside the holding pattern airspace area and will assist any detected aircraft to return to the assigned airspace area.

NOTE.— Many factors could prevent ATC from providing this additional service, such as workload, number of targets, precipitation, ground clutter, and radar system capability. These circumstances may make it unfeasible to maintain radar identification of aircraft to detect aircraft straying from the holding pattern. The provision of this service depends entirely upon whether the controller believes he is in a position to provide it and does not relieve a pilot of his responsibility to adhere to an accepted ATC clearance.

(3) If an aircraft is established in a published holding pattern at an assigned altitude above the published minimum holding altitude and subsequently cleared for the approach, the pilot may descend to the published minimum holding altitude. The holding pattern would only be a segment of the IAP *if* it is published on the instrument procedure chart and is used in lieu of a procedure turn.

m. For those holding patterns where there are no published minimum holding altitudes, the pilot, upon receiving an approach clearance, must maintain his last assigned altitude until leaving the holding pattern and established on the inbound course. Thereafter, the published minimum altitude of the route segment being flown will apply. It is expected that the pilot will be assigned a holding altitude that will permit a normal descent on the inbound course.

348—359. RESERVED

Section 8. ARRIVAL PROCEDURES

360. STANDARD TERMINAL ARRIVAL (STAR)

a. A STAR is an ATC coded IFR arrival route established for application to arriving IFR aircraft destined for certain airports. Its purpose is to simplify clearance delivery procedures.

b. Pilots of IFR civil aircraft destined to locations for which STARs have been published may be issued a clearance containing a STAR whenever ATC deems it appropriate. Until military STAR publications and distribution is accomplished, STARs will be issued to military pilots only when requested in the flight plan or verbally by the pilot.

c. Use of STARs requires pilot possession of at least the approved textual description. As with any ATC clearance or portion thereof, it is the responsibility of each pilot to accept or refuse an issued STAR. A pilot should notify ATC if he does not wish to use a STAR by placing "NO STAR" in the remarks section of the flight plan or by the less desirable method of verbally stating the same to ATC.

d. A bound booklet containing all STAR charts is available on subscription from the National Ocean Service.

361. LOCAL FLOW TRAFFIC MANAGEMENT PROGRAM

a. This program is a continuing effort by the FAA to enhance safety, minimize the impact of aircraft noise and conserve aviation fuel. The enhancement of safety and reduction of noise is achieved in this program by minimizing low altitude maneuvering of arriving turbojet and turboprop aircraft weighing more than 12,500 pounds and, by permitting departure aircraft to climb to higher altitudes sooner, as arrivals are operating at higher altitudes at the points where their flight paths cross. The application of these procedures also reduces exposure time between controlled aircraft and uncontrolled aircraft at the lower altitudes in and around the terminal environment. Fuel conservation is accomplished by absorbing any necessary arrival delays for aircraft included in this program operating at the higher and more fuel efficient altitudes.

b. A fuel efficient descent is basically an uninterrupted descent (except where level flight is required for speed adjustment) from cruising altitude to the point when level flight is necessary for the pilot to stabilize his final approach. The procedure for a fuel efficient descent is based on an altitude loss which is most efficient for the majority of aircraft being served. This will generally result in a descent gradient window of 250-350 feet per nautical mile.

c. When crossing altitudes and speed restrictions are issued verbally or are depicted on a chart, ATC will expect the pilot to descend first to the crossing altitude and then reduce speed. Verbal clearances for descent will normally permit an uninterrupted descent in accordance with the procedure as described in paragraph b. above. Acceptance of a charted fuel efficient descent (Runway Profile Descent) clearance requires the pilot to adhere to the altitudes, speeds, and headings depicted on the charts unless otherwise instructed by ATC. PILOTS RECEIVING A CLEARANCE FOR A FUEL EFFICIENT DESCENT ARE EXPECTED TO ADVISE ATC IF THEY DO NOT HAVE RUNWAY PROFILE DESCENT CHARTS PUBLISHED FOR THAT AIRPORT OR ARE UNABLE TO COMPLY WITH THE CLEARANCE.

362. APPROACH CONTROL

a. Approach control is responsible for controlling all instrument flight operating within its area of responsibility. Approach control may serve one or more airfields, and control is exercised primarily by direct pilot and controller communications. Prior to arriving at the destination radio facility, instructions will be received from ARTCC to contact approach control on a specified frequency.

b. Radar Approach Control

(1) Where radar is approved for approach control service, it is used not only for radar approaches (ASR and PAR) but is also used to provide vectors in conjunction with published nonradar approaches based on radio NAVAIDs (ILS, MLS, VOR, NDB, TACAN). Radar vectors can provide course guidance and expedite traffic to the final approach course of any established IAP or to the traffic pattern for a visual approach. Approach control facilities that provide this radar service will operate in the following manner:

(a) Arriving aircraft are either cleared to an outer fix most appropriate to the route being flown with vertical separation and, if required, given holding information or, when radar handoffs are effected between the ARTCC and approach control, or between two approach control facilities, aircraft are cleared to the airport or to a fix so located that the handoff will be completed prior to the time the aircraft reaches the fix. When radar handoffs are utilized, successive arriving flights may be handed off to approach control with radar separation in lieu of vertical separation.

(b) After release to approach control, aircraft are vectored to the final approach course (ILS, MLS, VOR, ADF, etc.). Radar vectors and altitude or flight levels will be issued as required for spacing and separating aircraft. *Therefore, pilots must not deviate from the headings issued by approach control.* Aircraft will normally be informed when it is necessary to vector across the final approach course for spacing or other reasons. If approach course crossing is imminent and the pilot has not been informed that he will be vectored across the final approach course, he should query the controller.

(c) The pilot is not expected to turn inbound on the final approach course unless an approach clearance has been issued. This clearance will normally be issued with the final vector for interception of the final approach course, and the vector will be such as to enable the pilot to establish his aircraft on the final approach course prior to reaching the final approach fix.

(d) In the case of aircraft already inbound on the final approach course, approach clearance will be issued

prior to the aircraft reaching the final approach fix. When established inbound on the final approach course, radar separation will be maintained and the pilot will be expected to complete the approach utilizing the approach aid designated in the clearance (ILS, MLS, VOR, radio beacons, etc.) as the primary means of navigation. Therefore, once established on the final approach course, pilots must not deviate from it unless a clearance to do so is received from ATC.

(e) After passing the final approach fix on final approach, aircraft are expected to continue inbound on the final approach course and complete the approach or effect the missed approach procedure published for that airport.

(2) Whether aircraft are vectored to the appropriate final approach course or provide their own navigation on published routes to it, radar service is automatically terminated when the landing is completed or when instructed to change to advisory frequency at uncontrolled airports, whichever occurs first.

363. ADVANCE INFORMATION ON INSTRUMENT APPROACH

a. When landing at airports with approach control services and where two or more IAPs are published, pilots will be provided in advance of their arrival with the type of approach to expect or that they may be vectored for a visual approach. This information will be broadcast either by a controller or on ATIS. It will not be furnished when the visibility is three miles or better and the ceiling is at or above the highest initial approach altitude established for any low altitude IAP for the airport.

b. The purpose of this information is to aid the pilot in planning arrival actions; however, it is not an ATC clearance or commitment and is subject to change. Pilots should bear in mind that fluctuating weather, shifting winds, blocked runway, etc., are conditions which may result in changes to approach information previously received. It is important that the pilot advise ATC immediately if he is unable to execute the approach ATC advised will be used, or if he prefers another type of approach.

c. When making an IFR approach to an airport not served by a tower or FSS, after the ATC controller advises "CHANGE TO ADVISORY FREQUENCY APPROVED" you should broadcast your intentions, including the type of approach being executed, your position, and when over the final approach fix inbound (non precision approach) or when over the outer marker or fix used in lieu of the outer marker inbound (precision approach). Continue to monitor the appropriate frequency (UNICOM, etc.) for reports from other pilots.

364. INSTRUMENT APPROACH PROCEDURE CHARTS

a. FAR—91.116a (Instrument Approaches to Civil Airports) requires the use of SIAPs prescribed for the airport in Part 97 unless otherwise authorized by the Administrator (including ATC). FAR—91.116g (Military Airports) requires civil pilots flying into or out of military airports to comply with the IAPs and takeoff and landing minimums prescribed by the authority having jurisdiction at those airports.

(1) All IAPs (standard and special, civil and militar are based on joint civil and military criteria contained i the U.S. Standard for TERPs. The design of IAPs based o criteria contained in TERPs, takes into account the inter lationship between airports, facilities, and the surroundi environment, terrain, obstacles, noise sensitivity, etc. Ap propriate altitudes, courses, headings, distances, and othe limitations are specified and, once approved, the proc dures are published and distributed by government an commercial cartographers as instrument approach chart

(2) Not all IAPs are published in chart form. Rad IAPs are established where requirements and faciliti exist but they are printed in tabular form in appropria U.S. Government Flight Information Publications.

(3) A pilot adhering to the altitudes, flight paths, an weather minimums depicted on the IAP chart or vecto and altitudes issued by the radar controller, is assured o terrain and obstruction clearance and runway or airpo alignment during approach for landing.

(4) IAPs are designed to provide an IFR descent fro the en route environment to a point where a safe landi can be made. They are prescribed and approved by appro priate civil or military authority to ensure a safe desce during instrument flight conditions at a specific airport. I is important that pilots understand these procedures an their use prior to attempting to fly instrument approache

(5) TERPs criteria are provided for the following typ of instrument approach procedures:

(a) Precision approaches where an electronic gli slope is provided (PAR and ILS) and,

(b) Nonprecision approaches where glide slope i formation is not provided (all approaches except PAR an ILS).

b. The method used to depict prescribed altitudes on i strument approach charts differs according to techniqu employed by different chart publishers. Prescribed al tudes may be depicted in three different configuratio Minimum, maximum, and mandatory. The U.S. Government distributes charts produced by Defense Mappin Agency (DMA) and NOS. Altitudes are depicted on thes charts in the profile view with underscore, overscore, o both to identify them as minimum, maximum, or mandatory.

(1) Minimum Altitude will be depicted with the al tude value underscored. Aircraft are required to mainta altitude at or above the depicted value.

(2) Maximum Altitude will be depicted with the al tude value overscored. Aircraft are required to maintain a titude at or below the depicted value.

(3) Mandatory Altitude will be depicted with the al tude value both underscored and overscored. Aircraft ar required to maintain altitude at the depicted value.

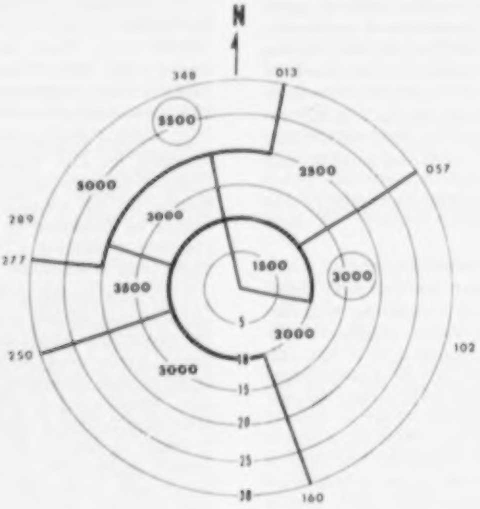
NOTE.— The underscore and overscore to identify mandato altitudes and the overscore to identify maximum altitudes a used almost exclusively by DMA for military charts. With ve few exceptions, civil approach charts produced by NOS utilize on the underscore to identify minimum altitudes. Pilots are caution to adhere to altitudes as prescribed because, in certain instanc they may be used as the basis for vertical separation of aircraft b ATC. When a depicted altitude is specified in the ATC clearan that altitude becomes mandatory as defined above.

c. Minimum Safe Altitudes (MSA) are published for emergency use on approach procedure charts utilizing NDB or VOR type facilities. The altitude shown provides at least 1,000 feet of clearance above the highest obstacle in the defined sector to a distance of 25 NM from the facility. As many as four sectors may be depicted with different altitudes for each sector displayed in rectangular boxes in the plan view of the chart. A single altitude for the entire area may be shown in the lower right portion of the plan view. Navigational course guidance is not assured at the MSA within these sectors.

d. Minimum Vectoring Altitudes (MVA) are established for use by ATC when radar ATC is exercised. MVA charts are prepared by air traffic facilities at locations where there are numerous different minimum IFR altitudes. Each MVA chart has sectors large enough to accommodate vectoring of aircraft within the sector at the MVA. Each sector boundary is at least 3 miles from the obstruction determining the MVA. To avoid a large sector with an excessively high MVA due to an isolated prominent obstruction, the obstruction may be enclosed in a buffer area whose boundaries are at least 3 miles from the obstruction. This is done to facilitate vectoring around the obstruction.

(1) The minimum vectoring altitude in each sector provides 1,000 feet above the highest obstacle in nonmountainous areas and 2,000 feet above the highest obstacle in designated mountainous areas. Where lower MVAs are required in designated mountainous areas to achieve compatibility with terminal routes or to permit vectoring to an IAP, 1,000 feet of obstacle clearance may be authorized with the use of Airport Surveillance Radar (ASR). The minimum vectoring altitude will provide at least 300 feet above the floor of controlled airspace.

(2) Because of differences in the areas considered for MVA, and those applied to other minimum altitudes, and the ability to isolate specific obstacles, some MVAs may be lower than the nonradar Minimum En route Altitudes (MEA), Minimum Obstruction Clearance Altitudes (MOCA) or other minimum altitudes depicted on charts for a given location. While being radar vectored, IFR altitude assignments by ATC will be at or above MVA.



e. Visual Descent Points (VDP) are incorporated in selected nonprecision approach procedures. The VDP is a defined point on the final approach course of a nonprecision straight-in approach procedure from which normal descent from the MDA to the runway touchdown point may be commenced, provided visual reference required by FAR—91.116(c)(3) is established. The VDP will normally be identified by DME on VOR and LOC procedures. The VDP is identified on the profile view of the approach chart by the symbol: **V** .

(1) VDPs are intended to provide additional guidance where they are implemented. No special technique is required to fly a procedure with a VDP. The pilot should not descend below the MDA prior to reaching the VDP and acquiring the necessary visual reference in accordance with FAR—91.116(c)(3)(4).

(2) Pilots not equipped to receive the VDP should fly the approach procedure as though no VDP had been provided.

365. APPROACH CLEARANCE

a. An aircraft which has been cleared to a holding fix and subsequently "cleared . . . approach" has not received new routing. Even though the "cleared . . . approach" may have been issued or received prior to the aircraft reaching the holding fix, ATC would expect the pilot to proceed via the holding fix (his last assigned route), a transition if one exists, and then to the initial approach fix to commence his approach.

b. If a transition fix is located along the route of flight en route to the holding fix and clearance for an approach is received, he should commence his approach from the transition fix if not already passed it.

c. If a route of flight directly to the initial approach fix is desired, it should be so stated by the controller with phraseology to include the words "direct . . .," "proceed direct" or a similar phrase which the pilot can interpret without question. If the pilot is uncertain of his clearance, he should immediately query ATC as to what route of flight is desired.

366—369. RESERVED

370. INSTRUMENT APPROACH PROCEDURES

a. Minimums are specified for various aircraft approach categories based upon a value 1.3 times the stalling speed of the aircraft in the landing configuration at maximum certificated gross landing weight. (See FAR 97.3(b)). If it is necessary, while circling to land, to maneuver at speeds in excess of the upper limit of the speed range for each category, due to the possibility of extending the circling maneuver beyond the area for which obstruction clearance is provided, the circling minimum for the next higher approach category should be used. For example, an aircraft which falls in Category C, but is circling to land at a speed of 141 knots or higher should use the approach category "D" minimum when circling to land.

b. When operating on an unpublished route or while being radar vectored, the pilot, when an approach clearance is received, shall, in addition to complying with the minimum altitudes for IFR operations (FAR—91.119), maintain his last assigned altitude unless a different altitude is assigned by ATC, or until the aircraft is established on a segment of a published route or IAP. After the aircraft is so established, published altitudes apply to descent within each succeeding route or approach segment unless a different altitude is assigned by ATC. Notwithstanding this pilot responsibility, for aircraft operating on unpublished routes or while being radar vectored, ATC will, except when conducting a radar approach, issue an IFR approach clearance only after the aircraft is established on a segment of a published route or IAP, or assigned an altitude to maintain until the aircraft is established on a segment of a published route or instrument approach procedure. For this purpose, the procedure turn of a published IAP shall not be considered a segment of that IAP until the aircraft reaches the initial fix or navigation facility upon which the procedure turn is predicated.

EXAMPLE:

CROSS REDDING VOR AT OR ABOVE FIVE THOUSAND, CLEARED FOR VOR RUNWAY THREE FOUR APPROACH. *or*

EXAMPLE:

FIVE MILES FROM OUTER MARKER, TURN RIGHT HEADING THREE THREE ZERO, MAINTAIN TWO THOUSAND UNTIL ESTABLISHED ON THE LOCALIZER, CLEARED FOR ILS RUNWAY THREE SIX APPROACH.

NOTE.— The altitude assigned will assure IFR obstruction clearance from the point at which the approach clearance is issued until established on a segment of a published route or IAP. If a pilot is uncertain of the meaning of his clearance, he shall immediately request clarification from ATC.

c. Several IAPs, using various navigation and approach aids may be authorized for an airport. ATC may advise that a particular approach procedure is being used, primarily to expedite traffic. (See PARA—363 - ADVANCE INFORMATION ON INSTRUMENT APPROACH.) If a pilot is issued a clearance that specifies a particular approach procedure, he is expected to notify ATC immediately if he desires a different one. In this event it may be necessary for ATC to withhold clearance for the different approach until such time as traffic conditions permit. However, if the pilot is involved in an emergency situation he will be given priority. If the pilot is not familiar with the specific approach procedure, ATC should be advised and they will provide detailed information on the execution of the procedure.

d. At times ATC may not specify a particular approach procedure in the clearance, but will state "CLEARED FOR APPROACH." Such clearance indicates that the pilot may execute any one of the authorized IAPs for that airport. This clearance does not constitute approval for the pilot to execute a contact approach or a visual approach.

e. When cleared for a specifically prescribed IAP; i.e., "cleared for ILS runway one niner approach" or when "cleared for approach" i.e., execution of any procedure prescribed for the airport, pilots shall execute the entire procedure as described on the IAP Chart unless an appropriate new or revised ATC clearance is received, or the IFR flight plan is cancelled.

f. Pilots planning flights to locations served by special IAPs should obtain advance approval from the owner of the procedure. Approval by the owner is necessary because special procedures are for the exclusive use of the single interest unless otherwise authorized by the owner. Additionally, some special approach procedures require certain crew qualifications training, or other special considerations in order to execute the approach. Also, some of these approach procedures are based on privately owned navigational aids. Owners of aids that are not for public use may elect to turn off the aid for whatever reason they may have; i.e., maintenance, conservation, etc. Air traffic controllers are not required to question pilots to determine if they have permission to use the procedure. Controllers presume a pilot has obtained approval and is aware of any details of the procedure if he files an IFR flight plan to that airport.

g. When executing an instrument approach and in radio contact with an FAA facility, unless in "radar contact," report passing the final approach fix inbound (non precision approach) or the outer marker or fix used in lieu of the outer marker inbound (precision approach).

h. If a missed approach is required, advise ATC and include the reason (unless initiated by ATC). Comply with the missed approach instructions for the instrument approach procedure being executed, unless otherwise directed by ATC. (See PARA—382 - MISSED APPROACH and PARA—404 - MISSED APPROACH.)

371. PROCEDURE TURN

a. A procedure turn is the maneuver prescribed when it is necessary to reverse direction to establish the aircraft inbound on an intermediate or final approach course. It is a required maneuver except when the symbol NoPT is shown, when RADAR VECTORING is provided, when a holding pattern is published in lieu of procedure turn, or when the procedure turn is not authorized. The altitude prescribed for the procedure turn is a *minimum* altitude until the aircraft is established on the inbound course. The maneuver must be completed within the distance specified in the profile view.

(1) On U.S. Government charts, a barbed arrow indicates the direction or side of the outbound course on which the procedure turn is made. Headings are provided for course reversal using the 45 degree type procedure turn. However, the point at which the turn may be commenced and the type and rate of turn is left to the discretion of the pilot. Some of the options are the 45 degree procedure turn, the racetrack pattern, the tear-drop procedure turn, or the 80 degree - 260 degree course reversal. Some procedure turns are specified by procedural track. These turns must be flown exactly as depicted.

(2) When the approach procedure involves a procedure turn, a maximum speed of not greater than 250 knots (IAS) should be observed and the turn should be executed within the distance specified in the profile view. The normal procedure turn distance is 10 miles. This may be reduced to a minimum of 5 miles where only Category A or helicopter aircraft are to be operated or increased to as much as 15 miles to accommodate high performance aircraft.

(3) A teardrop procedure or penetration turn may be specified in some procedures for a required course reversal. The teardrop procedure consists of departure from an initial approach fix on an outbound course followed by a turn toward and intercepting the inbound course at or prior to the intermediate fix or point. Its purpose is to permit an aircraft to reverse direction and lose considerable altitude within reasonably limited airspace. Where no fix is available to mark the beginning of the intermediate segment, it shall be assumed to commence at a point 10 miles prior to the final approach fix. When the facility is located on the airport, an aircraft is considered to be on final approach upon completion of the penetration turn. However, the final approach segment begins on the final approach course 10 miles from the facility.

(4) A procedure turn need not be established when an approach can be made from a properly aligned holding pattern. In such cases, the holding pattern is established over an intermediate fix or a final approach fix. The holding pattern maneuver is completed when the aircraft is established on the inbound course after executing the appropriate entry. If cleared for the approach prior to returning to the holding fix, and the aircraft is at the prescribed altitude, additional circuits of the holding pattern are not necessary nor expected by ATC. If the pilot elects to make additional circuits to lose excessive altitude or to become better established on course, it is his responsibility to so advise ATC when he receives his approach clearance.

(5) A procedure turn is not required when an approach can be made directly from a specified intermediate fix to the final approach fix. In such cases, the term "NoPT" is used with the appropriate course and altitude to denote that the procedure turn is not required. If a procedure turn is desired, and when cleared to do so by ATC, descent below the procedure turn altitude should not be made until the aircraft is established on the inbound course, since some NoPT altitudes may be lower than the procedure turn altitudes.

b. Limitations on Procedure Turns.

(1) In the case of a radar initial approach to a final approach fix or position, or a timed approach from a holding fix, or where the procedure specifies "NoPT", no pilot may make a procedure turn unless, when he receives his final approach clearance, he so advises ATC and a clearance is received.

(2) When a teardrop procedure turn is depicted and a course reversal is required, this type turn must be executed.

(3) When holding pattern replaces the procedure turn, the standard entry and the holding pattern must be followed except when RADAR VECTORING is provided or when NoPT is shown on the approach course. As in the procedure turn, the descent from the minimum holding pattern altitude to the final approach fix altitude (when lower) may not commence until the aircraft is established on the inbound course.

(4) The absence of the procedure turn barb in the Plan View indicates that a procedure turn is not authorized for that procedure.

372. TIMED APPROACHES FROM A HOLDING FIX

a. TIMED APPROACHES may be conducted when the following conditions are met:

(1) A control tower is in operation at the airport where the approaches are conducted.

(2) Direct communications are maintained between the pilot and the center or approach controller until the pilot is instructed to contact the tower.

(3) If more than one missed approach procedure is available, none require a course reversal.

(4) If only one missed approach procedure is available, the following conditions are met:

(a) Course reversal is not required; and,

(b) Reported ceiling and visibility are equal to or greater than the highest prescribed circling minimums for the IAP.

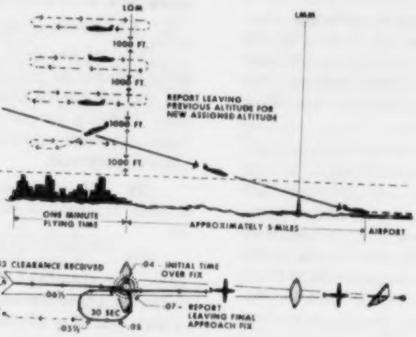
(5) When cleared for the approach, pilots shall not execute a procedure turn. (FAR—91.116(h).)

b. Although the controller will not specifically state that "timed approaches are in progress", his assigning a time to depart the final approach fix inbound (non precision approach) or the outer marker or fix used in lieu of the outer marker inbound (precision approach) is indicative that timed approach procedures are being utilized, or in lieu of holding, he may use radar vectors to the final approach course to establish a mileage interval between aircraft that will insure the appropriate time sequence between the final approach fix/outer marker or fix used in lieu of the outer marker and the airport.

c. Each pilot in an approach sequence will be given advance notice as to the time he should leave the holding point on approach to the airport. When a time to leave the holding point has been received, the pilot should adjust his flight path to leave the fix as closely as possible to the designated time.

EXAMPLE:

Time Approach Example — a final approach procedure from a holding pattern at a final approach fix (FAF).



At 12:03 local time, in the example shown, a pilot holding, receives instructions to leave the fix inbound at 12:07. These instructions are received just as the pilot has completed turn at the outbound end of the holding pattern and is proceeding inbound towards the fix. Arriving back over the fix, the pilot notes that the time is 12:04 and that he has 3 minutes to lose in order to leave the fix at the assigned time. Since the time remaining is more than 2 minutes, the pilot plans to fly a race track pattern rather than a 360 degrees turn, which would use up 2 minutes. The turns at the ends of the race track pattern will consume approximately 2 minutes. Three minutes to go,' minus 2 minutes required for turns, leaves 1 minute for level flight. Since two portions of level flight will be required to get back to the fix inbound, the pilot halves the 1 minute remaining and plans to fly level for 30 seconds outbound before starting his turn back toward the fix on final approach. If the winds were negligible at flight altitude, this procedure would bring the pilot inbound across the fix precisely at the specified time of 12:07. However, if the pilot expected a headwind on final approach, he should shorten his 30 seconds outbound course somewhat, knowing that the wind will carry him away from the fix faster while outbound and decrease his ground speed while returning to the fix. On the other hand, if the pilot knew he would have a tailwind on final approach, he should lengthen his calculated 30-second outbound heading somewhat, knowing that the wind would tend to hold him closer to the fix while outbound and increase his ground speed while returning to the fix.

373. RADAR APPROACHES

a. The only airborne radio equipment required for radar approaches is a functioning radio transmitter and receiver. The radar controller vectors the aircraft to align it with the runway centerline. The controller continues the vectors to keep the aircraft on course until the pilot can complete the approach and landing by visual reference to the surface. There are two types of radar approaches: Precision (PAR) and Surveillance (ASR).

b. A radar approach may be given to any aircraft upon request and may be offered to pilots of aircraft in distress or to expedite traffic, however, an ASR might not be approved unless there is an ATC operational requirement, or in an unusual or emergency situation. Acceptance of a PAR or ASR by a pilot does not waive the prescribed weather minimums for the airport or for the particular aircraft operator concerned. The decision to make a radar approach when the reported weather is below the established minimums rests with the pilot.

c. PAR and ASR minimums are published on separate pages in the NOS IAP Charts.

(1) **A PRECISION APPROACH (PAR)** is one in which a controller provides highly accurate nagivational guidance in azimuth and elevation to a pilot. Pilots are given headings to fly, to direct them to, and keep their aircraft aligned with the extended centerline of the landing runway. They are told to anticipate glide path interception approximately 10 to 30 seconds before it occurs and when to start descent. The published decision height will be given only if the pilot requests it. If the aircraft is observed to deviate above or below the glide path, the pilot is given the relative amount of deviation by use of terms "slightly" or "well" and is expected to adjust his rate of descent to return to the glide path. Trend information is also issued with respect to the elevation of the aircraft and may be modified by the terms "rapidly" and "slowly"; e.g., "well above glide path, coming down rapidly." Range from touchdown is given at least once each mile. If an aircraft is observed by the controller to proceed outside of specified safety zone limits in azimuth and/or elevation and continue to operate outside these prescribed limits, the pilot will be directed to execute a missed approach or to fly a specified course unless he has the runway environment (runway, approach lights, etc.) in sight. Navigational guidance in azimuth and elevation is provided the pilot until the aircraft reaches the published Decision Height (DH). Advisory course and glidepath information is furnished by the controller until the aircraft passes over the landing threshold, at which point the pilot is advised of any deviation from the runway centerline. Radar service is automatically terminated upon completion of the approach.

(2) **A SURVEILLANCE APPROACH (ASR)** is one in which a controller provides navigational guidance in azimuth only. The pilot is furnished headings to fly to align his aircraft with the extended centerline of the landing runway. Since the radar information used for a surveillance approach is considerably less precise than that used for a precision approach, the accuracy of the approach will not be as great and higher minimums will apply. Guidance in elevation is not possible but the pilot will be advised when to commence descent to the minimum descent altitude (MDA) or, if appropriate, to an intermediate step-down fix minimum crossing altitude and subsequently to the prescribed MDA. In addition, the pilot will be advised of the location of the missed approach point (MAP) prescribed for the procedure and his position each mile on final from the runway, airport or heliport or MAP, as appropriate. If requested by the pilot, recommended altitudes will be issued at each mile, based on the descent gradient established for the procedure, down to the last mile that is at or above the MDA. Normally, navigational guidance will be provided until the aircraft reaches the MAP. Controllers will terminate guidance and instruct the pilot to execute a missed approach unless at the MAP the pilot has the runway, airport or heliport in sight or, for a helicopter point-in-space approach, the prescribed visual reference with the surface is established. Also, if, at any time during the approach the controller considers that safe guidance for the remainder of the approach can not be provided, he will terminate guidance and instruct the pilot to execute a missed approach. Similarly, guidance termination and missed approach will be effected upon pilot request and, for civil aircraft only, controllers may terminate guidance when the pilot reports the runway, airport/heliport or visual surface route (point-in-space approach) in sight or otherwise indicates that continued guidance is not required. Radar service is automatically terminated at the completion of a radar approach.

NOTE.— The published MDA for straight-in approaches will be issued to the pilot before beginning descent. When a surveillance approach will terminate in a circle to land maneuver, the pilot must furnish the aircraft approach category to the controller. The controller will then provide the pilot with the appropriate MDA.

(3) **A NO-GYRO APPROACH** is available to a pilot under radar control who experiences circumstances wherein his directional gyro or other stabilized compass is inoperative or inaccurate. When this occurs, he should so advise ATC and request a No-Gyro vector or approach. Pilots of aircraft not equipped with a directional gyro or other stabilized compass who desire radar handling may also request a No-Gyro vector or approach. The pilot should make all turns at standard rate and should execute the turn immediately upon receipt of instructions. For example, "TURN RIGHT," "STOP TURN." When a surveillance or precision approach is made, the pilot will be advised after his aircraft has been turned onto final approach to make turns at half standard rate.

374. RADAR MONITORING OF INSTRUMENT APPROACHES

a. PAR facilities operated by the FAA and the military services at some joint-use (civil and military) and military installations monitor aircraft on instrument approaches and issue radar advisories to the pilot when weather is below VFR minimums (1,000 and 3), at night, or when requested by a pilot. This service is provided only when the PAR final approach course coincides with the final approach of the navigational aid and only during the operational hours of the PAR. The radar advisories serve only as a secondary aid since the pilot has selected the navigational aid as the primary aid for the approach.

b. Prior to starting final approach, the pilot will be advised of the frequency on which the advisories will be transmitted. If, for any reason, radar advisories cannot be furnished, the pilot will be so advised.

c. Advisory information, derived from radar observations, includes information on:

(1) Passing the final approach fix inbound (non precision approach) or passing the outer marker or fix used in lieu of the outer marker inbound (precision approach).

NOTE.— At this point, the pilot may be requested to report sighting the approach lights or the runway.

(2) Trend advisories with respect to elevation and/or azimuth radar position and movement will be provided.

NOTE.— Whenever the aircraft nears the PAR safety limit, the pilot will be advised that he is well above or below the glidepath or well left or right of course. Glidepath information is given only to those aircraft executing a precision approach, such as ILS or MLS. Altitude information is not transmitted to aircraft executing other than precision approaches because the descent portions of these approaches generally do not coincide with the depicted PAR glidepath. At locations where the MLS glidepath and PAR glidepath are not coincidental, only azimuth monitoring will be provided.

(3) If, after repeated advisories, the aircraft proceeds outside the PAR safety limit or if a radical deviation is observed, the pilot will be advised to execute a missed approach unless the prescribed visual reference with the surface is established.

d. Radar service is automatically terminated upon completion of the approach.

375. SIMULTANEOUS ILS/MLS APPROACHES

a. System: An approach system permitting simultaneous ILS/MLS, or ILS and MLS approaches to airports having parallel runways separated by at least 4,300 feet between centerlines. Integral parts of a total system are ILS or MLS, radar, communications, ATC procedures, and appropriate airborne equipment. The Approach Procedure

Chart permitting simultaneous approaches will contain the note "simultaneous approach authorized Rwys 14L and 14R" identifying the appropriate runways as the case may be. When advised that simultaneous ILS approaches are in progress, pilots shall advise approach control immediately of malfunctioning or inoperative receivers or if simultaneous approach is not desired.

b. Radar Monitor Service: This service is provided for each ILS/MLS to insure prescribed lateral separation during approaches. Pilots will be assigned frequencies to receive advisories and instructions. Aircraft deviating from either final approach course to the point where the no transgression zone (an area at least 2,000 feet wide) may be penetrated will be instructed to take corrective action. If an aircraft fails to respond to such instruction, the aircraft on the adjacent final approach course may be instructed to alter course.

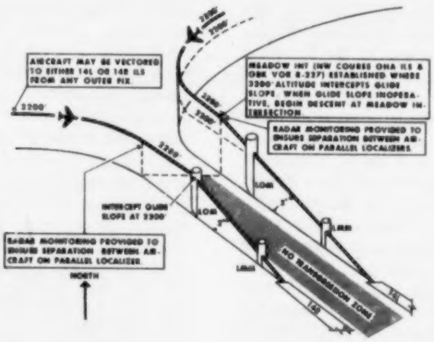
c. Radar Advisories: Whenever simultaneous approaches are in progress radar advisories will be provided on the tower frequency.

(1) The monitor controller will have the capability of overriding the tower controller on the tower frequency.

(2) The pilot will be advised to monitor the tower frequency.

(3) The monitor will automatically be terminated no farther than one mile from the runway threshold.

(4) The monitor controller will *not* advise when the monitor is terminated.


AIRCRAFT MAY BE VECTORED TO EITHER 14L OR 14R ILS FROM ANY OUTER FIX.
2200'
2200'
2200'
3300'
3300'
MEADOW INT (NW COURSE OHA ILS & OBK VOR R-227) ESTABLISHED WHERE 3300' ALTITUDE INTERCEPTS GLIDE SLOPE. WHEN GLIDE SLOPE INOPERATIVE, BEGIN DESCENT AT MEADOW INTERSECTION.
RADAR MONITORING PROVIDED TO INSURE SEPARATION BETWEEN AIRCRAFT ON PARALLEL LOCALIZERS
INTERCEPT GLIDE SLOPE AT 2200'
LOM
LOM
LMM
LMM
RADAR MONITORING PROVIDED TO INSURE SEPARATION BETWEEN AIRCRAFT ON PARALLEL LOCALIZER
NORTH
NO TRANSGRESSION ZONE
14L
14R

376. PARALLEL ILS/MLS APPROACHES

a. Parallel approaches are an ATC procedure permitting parallel ILS, MLS, or ILS and MLS approaches to airports having parallel runways separated by at least 2,500 feet between centerlines. Integral parts of a total system are ILS or MLS, radar, communications, ATC procedures, and appropriate airborne equipment.

b. A parallel approach differs from a simultaneous approach in that the minimum distance between parallel runway centerlines is reduced; there is no requirement for radar monitoring or advisories; and a staggered separation of aircraft on the adjacent localizer course is required.

c. Aircraft are afforded a minimum of two miles radar separation between successive aircraft on the adjacent localizer course and a minimum of three miles radar separation from aircraft on the same final approach course. In addition, a minimum of 1,000 feet vertical or a minimum of three miles radar separation is provided between aircraft during turn on.

d. Whenever parallel approaches are in progress, aircraft are informed that approaches to both runways are in use. In addition, the radar controller will have the interphone capability of communicating directly with the tower controller where the responsibility for radar separation is not performed by the tower controller.

377. SIMULTANEOUS CONVERGING INSTRUMENT APPROACHES

a. ATC may conduct instrument approaches simultaneously to converging runways; i.e., runways having an included angle from 15 to 100 degrees, at airports where a program has been specifically approved to do so.

b. The basic concept requires that dedicated, separate standard instrument approach procedures be developed for each converging runway included. Missed approach points must be as least 3 miles apart and missed approach procedures ensure that missed approach protected airspace does not overlap.

c. Other requirements are: radar availability, nonintersecting final approach courses, precision (ILS/MLS) approach systems on each runway and, if runways intersect, controllers must be able to apply visual separation as well as intersecting runway separation criteria. Intersecting runways also require minimums of at least 700 and 2. Straight in approaches and landings must be made.

d. Whenever simultaneous converging approaches are in progress, aircraft will be informed by the controller as soon as feasible after initial contact or via ATIS. Additionally, the radar controller will have direct communications capability with the tower controller where separation responsibility has not been delegated to the tower.

378—379. RESERVED

380. SIDE-STEP MANEUVER

a. ATC may authorize an approach procedure which serves either one of parallel runways that are separated by 1,200 feet or less followed by a straight-in landing on the adjacent runway.

b. Aircraft that will execute a side-step maneuver will be cleared for a specified approach and landing on the adjacent parallel runway. Example, "cleared for ILS runway 07 left approach, side-step to runway 07 right." Pilots are expected to commence the side-step maneuver as soon as possible after the runway or runway environment is in sight.

c. Landing minimums to the adjacent runway will be higher than the minimums to the primary runway, but will normally be lower than the published circling minimums.

381. WEATHER MINIMUMS

a. **LANDING MINIMUMS.** The rules applicable to landing minimums are contained in FAR—91.116.

b. **Straight-in-minimums** are shown on IAP charts when the final approach course of the IAP is within 30 degrees of the runway alignment and a normal descent can be made from the IFR altitude shown on the IAPs to the runway surface. When either the normal rate of descent or the runway alignment factor of 30 degrees is exceeded, a straight-in minimum is not published and a circling minimum applies. The fact that a straight-in minimum is not published does not preclude the pilot from landing straight-in if he has the active runway in sight and has sufficient time to make a normal approach for landing. Under such conditions and when ATC has cleared him for landing on that runway, he is not expected to circle even though only circling minimums are published. If he desires to circle he should advise ATC.

c. **Side-Step Maneuver Minimums** — Landing minimums for a side-step maneuver to the adjacent runway will be higher than the minimums to the primary runway but will normally be lower than the published circling minimums.

d. **Circling Minimums** —The circling minimums published on the instrument approach chart provide adequate obstruction clearance and the pilot should not descend below the circling altitude until the aircraft is in a position to make final descent for landing. Sound judgement and knowledge of his and the aircraft's capabilities are the criteria for a pilot to determine the exact maneuver in each instance since airport design and the aircraft position, altitude and airspeed must all be considered. The following basic rules apply:

(1) Maneuver the shortest path to the base or downwind leg, as appproriate, under minimum weather conditions. There is no restriction from passing over the airport or other runways.

(2) It should be recognized that many circling maneuvers may be made while VFR or other flying is in progress at the airport. Standard left turns or specific instruction from the controller for maneuvering must be considered when circling to land.

(3) At airports without a control tower, it may be desirable to fly over the airport to determine wind and turn indicators, and to observe other traffic which may be on the runway or flying in the vicinity of the airport.

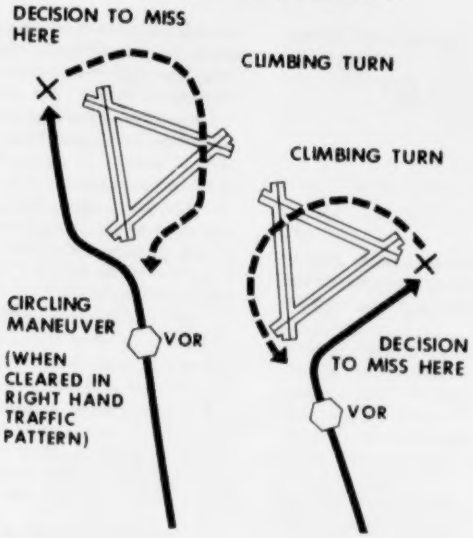
e. **Instrument Approach At a Military Field** — When instrument approaches are conducted by civil aircraft at military airports, they shall be conducted in accordance with the procedures and minimums approved by the military agency having jurisdiction over the airport.

382. MISSED APPROACH

a. When a landing cannot be accomplished, advise ATC and, upon reaching the missed approach point defined on the approach procedure chart, the pilot must comply with the missed approach instructions for the procedure being used or with an alternate missed approach procedure specified by ATC.

b. Protected obstacle clearance areas for missed approach are predicated on the assumption that the abort is initiated at the missed approach point not lower than the MDA or DH. Reasonable buffers are provided for normal maneuvers. However, no consideration is given to an abnormally early turn. Therefore, when an early missed approach is executed, pilots should, unless otherwise cleared by ATC, fly the IAP as specified on the approach plate to the missed approach point at or above the MDA or DH before executing a turning maneuver.

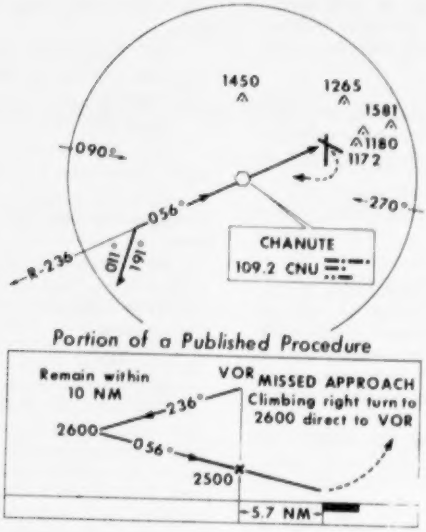
c. If visual reference is lost while circling to land from an instrument approach, the missed approach specified for that particular procedure must be followed (unless an alternate missed approach procedure is specified by ATC). To become established on the prescribed missed approach course, the pilot should make an initial climbing turn toward the landing runway and continue the turn until he is established on the missed approach course. Inasmuch as the circling maneuver may be accomplished in more than one direction, different patterns will be required to become established on the prescribed missed approach course, depending on the aircraft position at the time visual reference is lost. Adherence to the procedure will assure that an aircraft will remain within the circling and missed approach obstruction clearance areas.


DECISION TO MISS HERE
CLIMBING TURN
CLIMBING TURN
CIRCLING MANEUVER
(WHEN CLEARED IN RIGHT HAND TRAFFIC PATTERN)
VOR
DECISION TO MISS HERE
VOR

d. At locations where ATC Radar Service is provided, the pilot should conform to radar vectors when provided by ATC in lieu of the published missed approach procedure.

See diagram next page.

MISSED APPROACH-EXAMPLE



e. When approach has been missed, request clearance for specific action; i.e., to alternative airport, another approach, etc.

383. VISUAL APPROACH

a. When it will be operationally beneficial, ATC may authorize an aircraft to conduct a visual approach to an airport or to follow another aircraft when flight to, and landing at, the airport can be accomplished in VFR weather. The aircraft must have the airport or the identified preceding aircraft in sight before the clearance is issued. If the pilot has the airport in sight but cannot see the aircraft he is following, ATC may still clear the aircraft for a visual approach; however, ATC retains both separation and wake vortex separation responsibility. When visually following a preceding aircraft, acceptance of the visual approach clearance, constitutes acceptance of pilot responsibility for maintaining a safe approach interval and adequate wake turbulence separation.

b. When operating to an airport with an operating control tower, aircraft may be authorized to conduct a visual approach to one runway while other aircraft are conducting IFR or VFR approaches to another runway. When operating to airports with parallel runways separated by less than 2,500 feet, the succeeding aircraft must report sighting the preceding aircraft unless standard separation is being provided by ATC. When operating to parallel runways separated by at least 2,500 feet but less than 4,300 feet, controllers will clear/vector aircraft to the final at an angle not greater than 30 degrees unless radar, vertical, or visual separation is provided during the turn-on. The purpose of the 30 degree intercept angle is to reduce the potential for overshoots of the final and to preclude side-by-side operations with one or both aircraft in a *belly-up* configuration during the turn-on. Once the aircraft are established within 30 degrees of final, or on the final, these operations may be conducted simultaneously. When the parallel runways are separated by 4,300 feet or more, or intersecting/converging runways are in use, ATC may authorize a visual approach after advising all aircraft involved that other aircraft are conducting operations to the other runway.

c. When operating to an airport without weather reporting service, ATC may initiate a visual approach provided area weather reports indicate that VFR conditions exist at the airport and there is reasonable assurance that descent and flight to the airport can be made in VFR conditions. Pilot acceptance of a visual approach clearance or a pilot's request for a visual approach will indicate to ATC that the pilot can comply with FAR 91.105. ATC will advise the pilot when weather is not available at the destination airport.

d. Authorization to conduct a visual approach is an IFR authorization and does not alter IFR flight plan cancellation responsibility. (See PARA—304 - CANCELLING IFR FLIGHT PLAN.)

e. A visual approach is not an IAP and therefore has no missed approach segment. If a go around is necessary for any reason, aircraft operating at controlled airports will be issued an appropriate advisory/clearance/instruction by the tower. At uncontrolled airports, aircraft are expected to remain in VFR conditions and complete a landing as soon as possible. If a landing cannot be accomplished, the aircraft is expected to remain in VFR conditions and contact ATC as soon as possible for further clearance. Separation from other IFR aircraft will be maintained under these circumstances.

f. Visual approaches are initiated by ATC to reduce pilot/controller workload and expedite traffic by shortening flight paths to the airport. It is the pilot's responsibility to advise ATC as soon as possible if a visual approach is not desired.

384. CHARTED VISUAL FLIGHT PROCEDURES (CVFP)

a. In addition to conventional visual approaches, it has been necessary to develop CVFPs at some locations with jet operations. Although arrival routes/altitudes are specified to enhance noise abatement, they may be utilized by all categories of aircraft. CVFPs are used only in a radar environment at airports served by an operating control tower. These airports must also have weather reporting service. CVFPs originate over or near a prominent landmark. When the landmark cannot be readily identified at night, the procedure will be annotated, *PROCEDURE NOT AUTHORIZED AT NIGHT*. An aircraft not following another aircraft on approach may be cleared for a CVFP when it reports a charted visual landmark in sight.

b. Aircraft following another aircraft on approach must report sighting the preceding aircraft unless ATC is providing standard separation. When visually following a preceding aircraft, acceptance of a CVFP clearance constitutes pilot acceptance of responsibility for maintaining a safe approach interval and adequate wake turbulence separation. Recommended altitudes are established to indicate the noise abatement profile and minimum altitudes may be specified to contain aircraft above the floor of a TCA. These altitudes are not used by ATC for air traffic separation. Unless a particular CVFP has higher minimums established, ATC will use the same weather criteria as visual approaches. Controllers will also apply the same separation criteria as visual approaches. A CVFP is not an instrument approach, therefore, it does not have a missed approach segment. Aircraft unable to complete a CVFP approach will be handled as any go-around.

385. CONTACT APPROACH

a. Pilots operating in accordance with an IFR flight plan, provided they are clear of clouds and have at least 1 mile flight visibility and can reasonably expect to continue to the destination airport in those conditions, may request ATC authorization for a contact approach.

b. Controllers may authorize a contact approach provided:

(1) The Contact Approach is specifically requested by the pilot. ATC cannot initiate this approach.

EXAMPLE:

REQUEST CONTACT APPROACH.

(2) The reported ground visibility at the destination airport is at least 1 statute mile.

(3) The contact approach will be made to an airport having a standard or special instrument approach procedure.

(4) Approved separation is applied between aircraft so cleared and between these aircraft and other IFR or special VFR aircraft.

EXAMPLE:

CLEARED FOR CONTACT APPROACH (and, if required) AT OR BELOW (altitude) (Routing) IF NOT POSSIBLE (alternative procedures) AND ADVISE.

c. A Contact Approach is an approach procedure that may be used by a pilot (with prior authorization from ATC) in lieu of conducting a standard or special IAP to an airport. It is not intended for use by a pilot on an IFR flight clearance to operate to an airport not having an authorized IAP. Nor is it intended for an aircraft to conduct an instrument approach to one airport and then, when "in the clear", to discontinue that approach and proceed to another airport. In the execution of a contact approach, the pilot assumes the responsibility for obstruction clearance. If radar service is being received, it will automatically terminate when the pilot is told to contact the tower.

386. LANDING PRIORITY

A clearance for a specific type of approach (ILS, MLS, ADF, VOR or Straight-in Approach) to an aircraft operating on an IFR flight plan does not mean that landing priority will be given over other traffic. ATCTs handle all aircraft, regardless of the type of flight plan, on a "first-come, first-served" basis. Therefore, because of local traffic or runway in use, it may be necessary for the controller in the interest of safety, to provide a different landing sequence. In any case, a landing sequence will be issued to each aircraft as soon as possible to enable the pilot to properly adjust his flight path.

387—399. RESERVED

Section 9. PILOT/CONTROLLER ROLES AND RESPONSIBILITIES

400. GENERAL

a. The roles and responsibilities of the pilot and controller for effective participation in the ATC system are contained in several documents. Pilot responsibilities are in the FARs and the air traffic controller's are in the Air Traffic Control Handbook (7110.65) and supplemental FAA directives. Additional and supplemental information for pilots can be found in the current Airman's Information Manual (AIM), Notices to Airmen, Advisory Circulars and aeronautical charts. Since there are many other excellent publications produced by nongovernment organizations, as well as other government organizations, with various updating cycles, questions concerning the latest or most current material can be resolved by cross-checking with the above mentioned documents.

b. The pilot in command of an aircraft is directly responsible for, and is the final authority as to the safe operation of that aircraft. In an emergency requiring immediate action, the pilot in command may deviate from any rule in the General Subpart A and Flight Rules Subpart B in accordance with FAR—91.3.

c. The air traffic controller is responsible to give first priority to the separation of aircraft and to the issuance of radar safety alerts, second priority to other services that are required, but do not involve separation of aircraft and third priority to additional services to the extent possible.

d. In order to maintain a safe and efficient air traffic system, it is necessary that each party fulfill his responsibilities to the fullest.

e. The responsibilities of the pilot and the controller intentionally overlap in many areas providing a degree of redundancy. Should one or the other fail in any manner, this overlapping responsibility is expected to compensate, in many cases, for failures that may affect safety.

f. The following, while not intended to be all inclusive, is a brief listing of pilot and controller responsibilities for some commonly used procedures or phases of flight. More detailed explanations are contained in other portions of this publication, the appropriate FARs, ACs and similar publications. The information provided is an overview of the principles involved and is not meant as an interpretation of the rules nor is it intended to extend or diminish responsibilities.

401. AIR TRAFFIC CLEARANCE

a. Pilot

(1) Acknowledge receipt and understanding of an ATC clearance.

(2) Request clarification or amendment, as appropriate, any time a clearance is not fully understood, or considered unacceptable from a safety standpoint.

(3) Promptly comply with air traffic clearance upon receipt except as necessary to cope with an emergency. If deviation is necessary, advise ATC as soon as possible and obtain an amended clearance.

b. Controller

(1) Issues appropriate clearances for the operation to be conducted, or being conducted, in accordance with established criteria.

(2) Assigns altitudes in IFR clearances that are at or above the minimum IFR altitudes in controlled airspace.

(3) Ensures acknowledgement by the pilot for issued information, clearance or instructions.

(4) Ensures that readbacks by the pilot of altitude, heading, or other items are correct. If incorrect, distorted, or incomplete, makes corrections as appropriate.

402. CONTACT APPROACH

a. Pilot

(1) This approach must be requested by the pilot, and is made in lieu of a standard or special instrument approach.

(2) By requesting the contact approach, the pilot indicates that the flight is operating clear of clouds, has at least one mile flight visibility, and can reasonably expect to continue to the destination airport in those conditions.

(3) Be aware that while conducting a contact approach, the pilot assumes responsibility for obstruction clearance.

(4) Advise ATC immediately if you are unable to continue the contact approach or if you encounter less than one mile flight visibility.

b. Controller

(1) Issues clearance for contact approach only when requested by the pilot. Does not solict the use of this procedure.

(2) Before issuing clearance, ascertains that reported ground visibility at destination airport is at least one mile.

(3) Provides approved separation between aircraft cleared for contact approach and other IFR or special VFR aircraft. When using vertical separation, does not assign a fixed altitude but clears the aircraft at or below an altitude which is at least 1,000 feet below any IFR traffic but not below minimum safe altitudes prescribed in FAR—91.79.

(4) Issues alternative instructions if, in his judgment, weather conditions may make completion of the approach impracticable.

403. INSTRUMENT APPROACH

a. Pilot

(1) Be aware that the controller issues clearance for approach based only on known traffic.

(2) Follow the procedure as shown on the IAP, including all restrictive notations, such as:

(a) Procedure not authorized at night;

(b) Approach not authorized when local area altimeter not available;

(c) Procedure not authorized when control tower not in operation;

(d) Procedure not authorized when glide slope not used;

(e) Straight-in minimums not authorized at night; etc.

(f) Radar required; or

(g) The circling minimums published on the instrument approach chart provide adequate obstruction clearance and the pilot should not descend below the circling altitude until the aircraft is in a position to make final descent for landing. Sound judgment and knowledge of his and the aircraft's capabilities are the criteria for a pilot to determine the exact maneuver in each instance since airport design and the aircraft position, altitude and airspeed must all be considered. (See PARA—381d, - CIRCLING MINIMUMS)

(3) Upon receipt of an approach clearance while on an unpublished route or being radar vectored:

(a) Comply with the minimum altitude for IFR, and

(b) Maintain last assigned altitude until established on a segment of a published route or IAP, at which time published altitudes apply.

b. Controller

(1) Issues an approach clearance based on known traffic.

(2) Issues an IFR approach clearance only after the aircraft is established on a segment of published route or IAP, or assigns an appropriate altitude for the aircraft to maintain until so established.

404. MISSED APPROACH

a. Pilot

(1) Execute a missed approach when one of the following conditions exist:

(a) Arrival at the Missed Approach Point (MAP) or the Decision Height (DH) and visual reference to the runway environment is insufficient to complete the landing.

(b) Determined that a safe landing is not possible.

(c) Instructed to do so by ATC.

(2) Advise ATC that a missed approach will be made. Include the reason for the missed approach unless the missed approach is initiated by ATC.

(3) Comply with the missed approach instructions for the IAP being executed unless other *missed approach* instructions are specified by ATC.

(4) If executing a missed approach prior to reaching the MAP or DH, fly the instrument procedure to the MAP at an altitude at or above the Minimum Descent Altitude (MDA) or DH before executing a turning maneuver.

(5) Radar vectors issued by ATC when informed that a missed approach is being executed supersedes the previous missed approach procedure.

(6) If making a missed approach from a radar approach, execute the missed approach procedure previously given or climb to the altitude and fly the heading specified by the controller.

(7) Following missed approach, request clearance for specific action; i.e., another approach, hold for improved conditions, proceed to an alternate airport, etc.

b. Controller

(1) Issues an approved alternate missed approach procedure if it is desired that the pilot execute a procedure other than as depicted on the instrument approach chart.

(2) May vector a radar identified aircraft executing a missed approach when operationally advantageous to the pilot or the controller.

(3) In response to the pilot's stated intentions, issues a clearance to an alternate airport, to a holding fix, or for reentry into the approach sequence, as traffic conditions permit.

405. RADAR VECTORS

a. Pilot

(1) Promptly comply with headings and altitudes assigned to you by the controller.

(2) Question any assigned heading or altitude believed to be incorrect.

(3) If operating VFR and compliance with any radar vector or altitude would cause a violation of any FAR advise ATC and obtain a revised clearance or instruction

b. Controller

(1) Vectors aircraft in controlled airspace:

(a) For separation.

(b) For noise abatemen..

(c) To obtain an operational advantage for the pilot or controller.

(2) Vectors aircraft in controlled and uncontrolled airspace when requested by the pilot.

(3) Vectors IFR aircraft at or above minimum vectoring altitudes.

(4) May vector VFR aircraft, not at an ATC assigned altitude, at any altitude. In these cases, terrain separation is the pilot's responsibility.

406. SAFETY ALERT

a. Pilot

(1) Initiate appropriate action if a safety alert is received from ATC.

(2) Be aware that this service is not always available and that many factors affect the ability of the controller to be aware of a situation in which unsafe proximity to terrain, obstructions or another aircraft may be developing.

b. Controller

(1) Issues a safety alert if he is aware an aircraft under his control is at an altitude which, in the controller's judgment, places the aircraft in unsafe proximity to terrain, obstructions or another aircraft. Types of safety alerts are:

(a) **Terrain or Obstruction Alert:** — Immediately issued to an aircraft under his control if he is aware the aircraft is at an altitude believed to place the aircraft in unsafe proximity to terrain or obstructions.

(b) Aircraft Conflict Alert: — Immediately issued to an aircraft under his control if he is aware of an aircraft not under his control at an altitude believed to place the aircraft in unsafe proximity to each other. With the alert, he offers the pilot an alternative, if feasible.

(2) Discontinues further alerts if informed by the pilot that he is taking action to correct the situation or that he has the other aircraft in sight.

407. SEE AND AVOID

a. Pilot

(1) When meteorological conditions permit, regardless of type of flight plan, whether or not under control of a radar facility, the pilot is responsible to see and avoid other traffic, terrain or obstacles.

b. Controller

(1) Provides radar traffic information to radar identified aircraft operating outside positive control airspace on a workload permitting basis.

(2) Issues a safety alert to an aircraft under his control if he is aware the aircraft is at an altitude believed to place the aircraft in unsafe proximity to terrain, obstructions or other aircraft.

408. SPEED ADJUSTMENTS

a. Pilot

(1) Advise ATC any time cruising airspeed varies plus or minus 5 percent, or 10 knots, whichever is greater, from that given in the flight plan.

(2) Comply with speed adjustments from ATC unless:

(a) The minimum or maximum safe airspeed for any particular operation is greater or less than the requested airspeed. In such cases, advise ATC.

(b) Operating at or above 10,000 feet MSL on an ATC assigned SPEED ADJUSTMENT of more than 250 knots IAS and subsequent clearance is received for descent below 10,000 feet MSL. In such cases, pilots are expected to comply with FAR—91.70(a).

(3) When complying with speed adjustments assignment, maintain an indicated airspeed within plus or minus 10 knots or .02 mach numbers of the specified speed.

b. Controller

(1) Assigns speed adjustments to aircraft when necessary but not as a substitute for good vectoring technique.

(2) Adheres to the restrictions published in the Controllers Handbook (7110.65) as to when speed adjustment procedures may be applied.

(3) Avoids speed adjustments requiring alternate decreases and increases.

(4) Assigns speed adjustments to a specified IAS (KNOTS)/mach number or to increase or decrease speed using increments of 10 knots or multiples thereof.

(5) Advises pilots to resume normal speed when speed adjustments are no longer required.

(6) Gives due consideration to aircraft capabilities to reduce speed while descending.

409. TRAFFIC ADVISORIES (Traffic Information)

a. Pilot

(1) Acknowledge receipt of traffic advisories.

(2) Inform controller if traffic in sight.

(3) Advise ATC if a vector to avoid traffic is desired.

(4) Do not expect to receive radar traffic advisories on all traffic. Some aircraft may not appear on the radar display. Be aware that the controller may be occupied with higher priority duties and unable to issue traffic information for a variety of reasons.

(5) Advise controller if service not desired.

b. Controller

(1) Issues radar traffic to the maximum extent consistent with higher priority duties except in positive controlled airspace.

(2) Provides vectors to assist aircraft to avoid observed traffic when requested by the pilot.

(3) Issues traffic information to aircraft in the airport traffic area for sequencing purposes.

410. VISUAL APPROACH

a. Pilot

(1) If a visual approach is not desired, advise ATC.

(2) Comply with controller's instructions for vectors toward the airport of intended landing or to a visual position behind a preceding aircraft.

(3) After being cleared for a visual approach, proceed to the airport in a normal manner or follow designated traffic and/or charted flight procedures, as appropriate remaining in VFR at all times.

(4) Acceptance of a visual approach clearance to visually follow a preceeding aircraft is pilot acknowledgement that he will establish a safe landing interval behind the preceding aircraft, if so cleared, and that he accepts responsibility for his own wake turbulence separation.

(5) Advise ATC immediately if you are unable to continue following a designated aircraft or encounter less than basic VFR weather conditions.

(6) Be aware that radar service is automatically terminated without advising the pilot when the aircraft is instructed to contact the tower.

(7) Be aware that there may be other traffic in the traffic pattern and the landing sequence may differ from the traffic sequence assigned by the approach control or ARTCC.

b. Controller

(1) Does not vector an aircraft for a visual approach to an airport with weather reporting service unless the reported ceiling at the airport is 500 feet or more above the MVA and visibility is three miles or more.

(2) Informs the pilot when weather is not available for the destination airport and does not vector for a visual approach to those airports unless there is reasonable assurance that descent and flight to the airport can be made in VFR conditions.

(3) Does not clear an aircraft for a visual approach unless the aircraft is and can remain in VFR conditions.

(4) Issues visual approach clearance when the pilot reports sighting the airport or a preceding aircraft which is to be followed.

(5) Provides separation except when visual separation is being applied by the pilot of the aircraft executing the visual approach.

(6) Continues flight following and traffic information until the aircraft is instructed to contact the tower.

(7) Informs the pilot conducting the visual approach of the aircraft class when pertinent traffic is known to be a heavy aircraft.

411. VISUAL SEPARATION

a. Pilot

(1) Acceptance of instructions to follow another aircraft or to provide visual separation from it is an acknowledgment that the pilot will maneuver his/her aircraft as necessary to avoid the other aircraft or to maintain in-trail separation.

(2) If instructed by ATC to follow another aircraft or to provide visual separation from it, promptly notify the controller if you lose sight of that aircraft, are unable to maintain continued visual contact with it, or cannot accept the responsibility for your own separation for any reason.

(3) The pilot also accepts responsibility for wake turbulence separation under these conditions.

b. Controller

(1) Applies visual separation only within a terminal area when a controller has both aircraft in sight or by instructing a pilot who sees the other aircraft to maintain visual separation from it.

412. VFR-ON-TOP

a. Pilot

(1) This clearance must be requested by the pilot on an IFR flight plan and if approved, permits the pilot to select an altitude or flight level of his choice (subject to any ATC restrictions) in lieu of an assigned altitude.

Note 1.— VFR-ON-TOP is not permitted in certain airspace areas, such as positive control airspace, certain restricted areas, ect. Consequently, IFR flights operating VFR-ON-TOP will avoid such airspace.

Note 2.— See related AIM paragrphs, 98 - IFR Altitudes and Flight Levels, 266 - IFR Clearance VFR-ON-TOP, 271 - IFR Separation Standards, 341 - Position Reporting, and 342 - Additional Reports.

(2) By requesting a VFR-ON-TOP clearance, the pilot indicates that he is assuming the sole responsibility to be vigilant so as to see and avoid other aircraft and that he will:

(a) Fly at the appropriate VFR altitude as prescribed in FAR—91.109.

(b) Comply with the VFR visibility and distance from criteria in FAR—91.105 (Basic VFR Weather Minimums).

(c) Comply with instrument flight rules that are applicable to this flight (i.e., minimum IFR altitudes, position reporting, radio communications, course to be flown, adherence to ATC clearance, etc.).

(3) Should advise ATC prior to any altitude change to ensure the exchange of accurate traffic information.

b. Controller

(1) May clear an aircraft to maintain VFR-ON-TOP if the pilot of an aircraft on an IFR flight plan requests the clearance.

(2) Inform the pilot of an aircraft cleared to climb to VFR-ON-TOP: the reported height of the tops or that no top report is available, issues an alternate clearance if necessary, and once the aircraft reports reaching VFR-ON-TOP, reclears the aircraft to maintain VFR-ON-TOP.

(3) Before issuing clearance, ascertains that the aircraft is not in or will not enter positive control airspace

413. INSTRUMENT DEPARTURES

a. Pilot

(1) Prior to Departure: Consider the type of terrain and other obstructions on or in the vicinity of the departure airport.

(2) Determine if obstruction avoidance can be maintained visually or that the departure procedure should be followed.

(3) Determine whether a departure procedure and/or SID is available for obstruction avoidance.

(4) At airports where IAPs have not been published hence no published departure procedure, determine what action will be necessary and take such action that will assure a safe departure.

b. Controller

(1) At locations with airport traffic control service, when necessary, specifies direction of takeoff, turn or initial heading to be flown after takeoff.

(2) At locations without airport traffic control service, but within a control zone when necessary to specify direction of takeoff/turn or initial heading to be flown, obtains pilot's concurrence that the procedure will allow him to comply with local traffic patterns, terrain, and obstruction avoidance.

(3) Includes established departure procedures as part of the ATC clearance when pilot compliance is necessary to ensure separation.

414. MINIMUM FUEL ADVISORY

a. Pilot

(1) Advise ATC of your minimum fuel status when your fuel supply has reached a state where, upon reaching destination, you cannot accept any undue delay.

(2) Be aware this is not an emergency situation but merely an advisory that indicates an emergency situation is possible should any undue delay occur.

(3) Be aware a minimum fuel advisory does not imply a need for traffic priority.

(4) If the remaining usable fuel supply suggests the need for traffic priority to ensure a safe landing you should declare an emergency, account low fuel, and report fuel remaining in minutes.

b. Controller

(1) When an aircraft declares a state of minimum fuel, relay this information to the facility to whom control jurisdiction is transferred.

(2) Be alert for any occurrence which might delay the aircraft.

415—429. RESERVED

NOTES

Section 10. NATIONAL SECURITY AND INTERCEPTION PROCEDURES

430. NATIONAL SECURITY

a. National security in the control of air traffic is governed by (FAR—99).

b. All aircraft entering domestic U.S. airspace from points outside must provide for identification prior to entry. To facilitate early aircraft identification of all aircraft in the vicinity of U.S. and international airspace boundaries, Air Defense Identification Zones (ADIZ) have been established. (See PARA—433 - ADIZ BOUNDARIES AND DESIGNATED MOUNTAINOUS AREAS.)

c. Operational requirements for aircraft entering an ADIZ are as follows:

(1) Flight Plan — A flight plan must be filed with an appropriate aeronautical facility for flight in an ADIZ. In the Alaskan DEWIZ (Distant Early Warning Identification Zone), the flight plan must be filed before departure, except as otherwise permitted in FAR—99.13.

(2) Two-way Radio — An operative two-way radio must be available for flight in ADIZ/DEWIZ areas. Exceptions are only as provided in FAR—99.1.

(3) Position Reporting — Normal IFR position reports are required in all ADIZ/DEWIZ areas. In the domestic and coastal ADIZ areas, flights under Defense VFR (DVFR) flight plans must give the estimated time of ADIZ penetration at least 15 minutes prior to penetration. In the coastal ADIZ, inbound foreign aircraft must report at least 1 hour prior to ADIZ penetration. In the Alaskan DEWIZ, DVFR flights must report prior to penetration (correlation of ground filed flight plan data may be required).

(4) Aircraft Position Tolerances:

(a) In a domestic ADIZ tolerance is within plus or minus 5 minutes from the estimated time over a reporting point or point of penetration and within 10 NM from the centerline of an intended track over an estimated reporting point or penetration point.

(b) In a Coastal ADIZ/DEWIZ the tolerance is plus or minus 5 minutes from the estimated time over a reporting point or point of penetration and within 20 NM from the centerline of the intended track over an estimated reporting point or point of penetration.

d. Aircraft operating within an ADIZ may be exempted from the National Security requirements of FAR—99 (except as may be applicable under FAR—99.7) if the aircraft is operating:

(1) Within the 48 contiguous states and the District of Columbia, or within the State of Alaska, and remains within 10 miles of departure point.

(2) In a Coastal or Domestic ADIZ north of 30 degrees North latitude or west of 86 degrees West longitude at a true air speed of less than 180 knots.

(3) In Alaskan DEWIZ at TAS of less than 180 knots while pilot maintains listening watch on appropriate frequency.

(4) Over or within three miles of any island in Hawaiian Coastal ADIZ.

e. Exemptions (except for FAR—99.7) may also be granted by the ARTCC, on a local basis, for some operations within an ADIZ.

f. An Airfiled VFR Flight Plan makes an aircraft subject to interception for positive identification when entering an ADIZ. Pilots are therefore urged to file the required DVFR flight plan either in person or by telephone prior to departure.

g. Special Security Instructions

(1) During defense emergency or air defense emergency conditions, additional special security instructions may be issued in accordance with the Security Control of Air Traffic and Air Navigation Aids (SCATANA) Plan.

(2) Under the provisions of the SCATANA Plan, the military will direct the action to be taken—in regard to landing, grounding, diversion, or dispersal of aircraft and the control of air navigation aids in the defense of the U.S. during emergency conditions.

(3) At the time a portion of all of SCATANA is implemented, ATC facilities will broadcast appropriate instructions received from the military over available ATC frequencies. Depending on instructions received from the military, VFR flights may be directed to land at the nearest available airport, and IFR flights will be expected to proceed as directed by ATC.

(4) Pilots on the ground may be required to file a flight plan and obtain an approval (through FAA) prior to conducting flight operation.

(5) In view of the above, all pilots should guard an ATC or FSS frequency at all times while conducting flight operations.

431. INTERCEPTION PROCEDURES

a. General

(1) Identification intercepts during peacetime operations are vastly different than those conducted under increased states of readiness. Unless otherwise directed by the control agency, intercepted aircraft will be identified by type only. When specific information is required (i.e. markings, serial numbers, etc.) the interceptor aircrew will respond only if the request can be conducted in a safe manner. During hours of darkness or Instrument Meteorological Conditions (IMC), identification of unknown aircraft will be by type only. The interception pattern described below is the typical peacetime method used by air interceptor aircrews. In all situations, the interceptor aircrew will use caution to avoid startling the intercepted aircrew and/or passengers.

b. Intercept phases

(1) Phase One — Approach Phase: During peacetime, intercepted aircraft will be approached from the stern. Generally two interceptor aircraft will be employed to accomplish the identification. The flight leader and his wingman will coordinate their individual positions in conjunction with the ground controlling agency. Their rela-

tionship will resemble a line abreast formation. At night or in IMC, a comfortable radar trail tactic will be used. Safe vertical separation between interceptor aircraft and unknown aircraft will be maintained at all times.

(2) Phase Two — Identification Phase: The intercepted aircraft should expect to visually acquire the lead interceptor and possibly the wingman during this phase in visual meteorological conditions (VMC). The wingman will assume a surveillance position while the flight leader approaches the unknown aircraft. Intercepted aircraft personnel may observe the use of different drag devices to allow for speed and position stabilization during this phase. The flight leader will then initiate a gentle closure toward the intercepted aircraft, stopping at a distance no closer than absolutely necessary to obtain the information needed. The interceptor aircraft will use every possible precaution to avoid startling intercepted aircrew or passengers. Additionally, the interceptor aircrews will constantly keep in mind that maneuvers considered normal to a fighter aircraft may be considered hazardous to passengers and crews of nonfighter aircraft. When interceptor aircrews know or believe that an unsafe condition exists, the identification phase will be terminated. As previously stated, during darkness or IMC identification of unknown aircraft will be by type only. Positive vertical separation will be maintained by interceptor aircraft throughout this phase.

(3) Phase Three — Post Intercept Phase: Upon identification phase completion, the flight leader will turn away from the intercepted aircraft. The wingman will remain well clear and accomplish a rejoin with his leader.

c. Communication interface between interceptor aircrews and the ground controlling agency is essential to ensure successful intercept completion. Flight Safety is paramount. An aircraft which is intercepted by another aircraft shall immediately:

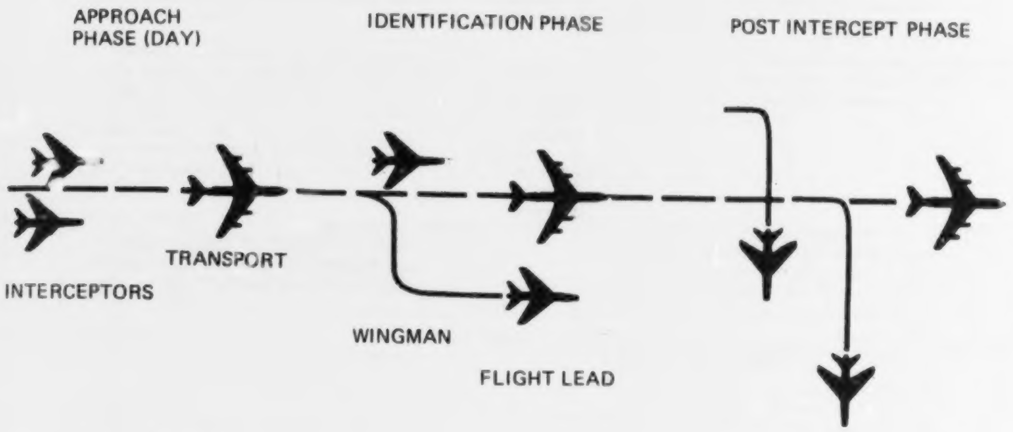
(1) Follow the instructions given by the intercepting aircraft, interpreting and responding to the visual signals.

(2) Notify, if possible, the appropriate air traffic services unit.

(3) Attempt to establish radio communication with the intercepting aircraft or with the appropriate intercept control unit, by making a general call on the emergency frequency 243.0 MHz and repeating this call on the emergency frequency 121.5 MHz, if practicable, giving the identity and position of the aircraft and the nature of the flight.

(4) If equipped with SSR transponder, select MODE 3/A Code 7700, unless otherwise instructed by the appropriate air traffic services unit. If any instructions received by radio from any sources conflict with those given by the intercepting aircraft by visual or radio signals, the intercepted aircraft shall request immediate clarification while continuing to comply with the instructions given by the intercepting aircraft.

INTERCEPTION PATTERNS
FOR IDENTIFICATION OF
INTERCEPTED AIRCRAFT
(TYPICAL)


APPROACH PHASE (DAY)
IDENTIFICATION PHASE
POST INTERCEPT PHASE
TRANSPORT
INTERCEPTORS
WINGMAN
FLIGHT LEAD

Note: During Night/IMC,
approach will be from
below flight path.

432. INTERCEPTION SIGNALS

INTERCEPTION SIGNALS

Signals initiated by intercepting aircraft and responses by intercepted aircraft (as set forth in ICAO Annex 2 — Appendix A, 2.1)

Series	INTERCEPTING Aircraft Signals	Meaning	INTERCEPTED Aircraft Responds	Meaning
1	DAY — Rocking wings from a position in front and, normally, to the left of intercepted aircraft and, after acknowledgement, a slow level turn, normally to the left, on to the desired heading. NIGHT — Same and, in addition, flashing navigational lights at irregular intervals. *Note 1. — Meteorological conditions or terrain may require the intercepting aircraft to take up a position in front and to the right of the intercepted aircraft and to make the subsequent turn to the right.* *Note 2. — If the intercepted aircraft is not able to keep pace with the intercepting aircraft, the latter is expected to fly a series of race-track patterns and to rock its wings each time it passes the intercepted aircraft.*	You have been intercepted. Follow me. NIGHT — Same and, in addition, flashing navigational lights at irregular intervals.	AEROPLANES: DAY — Rocking wings and following. Understood, will comply HELICOPTERS: DAY or NIGHT — Rocking aircraft, flashing navigational lights at irregular intervals and following.	
2	DAY or NIGHT — An abrupt break-away manoeuvre from the intercepted aircraft consisting of a climbing turn of 90 degrees or more without crossing the line of flight of the intercepted aircraft.	You may proceed.	AEROPLANES: DAY or NIGHT — Rocking wings. HELICOPTERS: DAY or NIGHT — Rocking aircraft.	Understood, will comply.
3	DAY — Circling aerodrome, lowering landing gear and overflying runway in direction of landing or, if the intercepted aircraft is a helicopter, overflying the helicopter landing area. NIGHT — Same and, in addition, showing steady landing lights.	Land at this aerodrome.	AEROPLANES: DAY — Lowering landing gear, following the intercepted aircraft and, if after overflying the runway landing is considered safe, proceeding to land. NIGHT — Same and, in addition, showing steady landing lights (if carried). HELICOPTERS: DAY or NIGHT — Following the intercepting aircraft and proceeding to land, showing a steady landing light (if carried).	Understood, will comply.

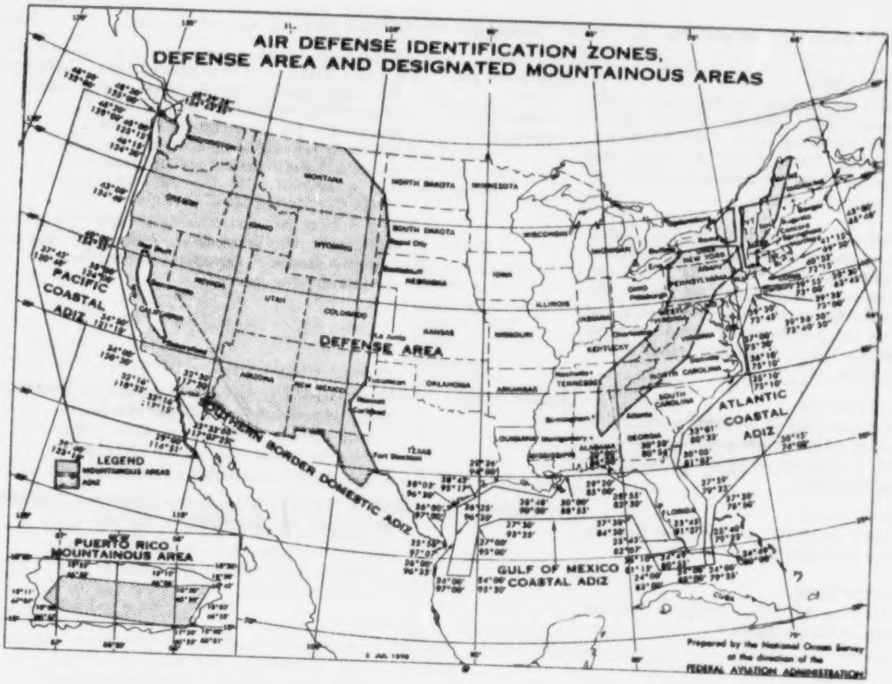
INTERCEPTION SIGNALS

Signals and Responses During Aircraft Intercept

Signals initiated by intercepted aircraft and responses by intercepting aircraft (as set forth in ICAO Annex 2 — Appendix A, 2.2)

Series	INTERCEPTED Aircraft Signals	Meaning	INTERCEPTING Aircraft Responds	Meaning
4	AEROPLANES: DAY — Raising landing gear while passing over landing runway at a height exceeding 300m (1,000 ft) but not exceeding 600m (2,000 ft) above the aerodrome level, and continuing to circle the aerodrome. NIGHT — Flashing landing lights while passing over landing runway at a height exceeding 300m (1,000 ft) but not exceeding 600m (2,000 ft) above the aerodrome level, and continuing to circle the aerodrome. If unable to flash landing lights, flash any other lights available.	Aerodrome you have designated is inadequate.	DAY or NIGHT — If it is desired that the intercepted aircraft follow the intercepting aircraft to an alternate aerodrome, the intercepting aircraft raises its landing gear and uses the Series 1 signals prescribed for intercepting aircraft. If it is decided to release the intercepted aircraft, the intercepting aircraft uses the Series 2 signals prescribed for intercepting aircraft.	Understood, follow me. Understood, you may proceed.
5	AEROPLANES: DAY or NIGHT — Regular switching on and off of all available lights but in such a manner as to be distinct from flashing lights.	Cannot comply.	DAY or NIGHT — Use Series 2 signals prescribed for intercepting aircraft.	Understood.
6	AEROPLANES: DAY or NIGHT — Irregular flashing of all available lights. HELICOPTERS: DAY or NIGHT — Irregular flashing of all available lights	In distress.	DAY or NIGHT — Use Series 2 signals prescribed for intercepting aircraft.	Understood.

433. ADIZ BOUNDARIES AND DESIGNATED MOUNTAINOUS AREAS


AIR DEFENSE IDENTIFICATION ZONES,
DEFENSE AREA AND DESIGNATED MOUNTAINOUS AREAS
PACIFIC COASTAL ADIZ
DEFENSE AREA
SOUTHERN BORDER DOMESTIC ADIZ
ATLANTIC COASTAL ADIZ
GULF OF MEXICO COASTAL ADIZ
PUERTO RICO MOUNTAINOUS AREA
LEGEND
MOUNTAINOUS AREAS
ADIZ
MONTANA
NORTH DAKOTA
MINNESOTA
SOUTH DAKOTA
WISCONSIN
OREGON
IDAHO
WYOMING
NEBRASKA
IOWA
ILLINOIS
NEVADA
UTAH
COLORADO
KANSAS
MISSOURI
CALIFORNIA
ARIZONA
NEW MEXICO
OKLAHOMA
ARKANSAS
TENNESSEE
KENTUCKY
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
ALABAMA
MISSISSIPPI
FLORIDA
TEXAS
NEW YORK
PENNSYLVANIA
OHIO
CUBA
Prepared by the National Ocean Survey
at the direction of the
FEDERAL AVIATION ADMINISTRATION

434—439. RESERVED

Chapter 5. EMERGENCY PROCEDURES

Section 1. GENERAL

440. PILOT RESPONSIBILITY AND AUTHORITY

a. The pilot in command of an aircraft is directly responsible for and is the final authority as to the operation of that aircraft. In an emergency requiring immediate action, the pilot in command may deviate from any rule in the FAR, Subpart A, General, and Subpart B, Flight Rules, to the extent required to meet that emergency. (FAR—91.3(b).)

b. If the emergency authority of FAR 91.3.(b) is used to deviate from the provisions of an ATC clearance, the pilot in command must notify ATC as soon as possible and obtain an amended clearance.

c. Unless deviation is necessary under the emergency authority of FAR—91.3, pilots of IFR flights experiencing two-way radio communications failure are expected to adhere to the procedures prescribed under "IFR operations, two-way radio communications failure." (FAR—91.127)

441. EMERGENCY CONDITION - REQUEST ASSISTANCE IMMEDIATELY

a. An emergency can be either a *distress* or *urgency* condition as defined in the Pilot/Controller Glossary. Pilots do not hesitate to declare an emergency when they are faced with *distress* conditions such as fire, mechanical failure, or structural damage. However, some are reluctant to report an *urgency* condition when they encounter situations which may not be immediately perilous, but are potentially catastrophic. An aircraft is in at least an *urgency* condition the moment the pilot becomes doubtful about position, fuel endurance, weather, or any other condition that could adversely affect flight safety. This is the time to ask for help, not after the situation has developed into a *distress* condition.

b. Pilots who become apprehensive for their safety for *any* reason should *request assistance immediately.* Ready and willing help is available in the form of radio, radar, direction finding stations and other aircraft. Delay has caused accidents and cost lives. *Safety is not a luxury! Take action!*

442—449. RESERVED

NOTES

Section 2. EMERGENCY SERVICES AVAILABLE TO PILOTS

450. RADAR SERVICE FOR VFR AIRCRAFT IN DIFFICULTY

a. Radar equipped ATC facilities can provide radar assistance and navigation service (vectors) to VFR aircraft in difficulty when the pilot can talk with the controller, and the aircraft is within radar coverage. Pilots should clearly understand that authorization to proceed in accordance with such radar navigational assistance does not constitute authorization for the pilot to violate FARs. In effect, assistance is provided on the basis that navigational guidance information is advisory in nature, and the responsibility for flying the aircraft safely remains with the pilot.

b. Experience has shown that many pilots who are not qualified for instrument flight cannot maintain control of their aircraft when they encounter clouds or other reduced visibility conditions. In many cases, the controller will not know whether flight into instrument conditions will result from his instructions. To avoid possible hazards resulting from being vectored into IFR conditions, a pilot in difficulty should keep the controller advised of the weather conditions in which he is operating and the weather along the course ahead and observe the following:

(1) If a course of action is available which will permit flight and a safe landing in VFR weather conditions, noninstrument rated pilots should choose the VFR condition rather than requesting a vector or approach that will take them into IFR weather conditions; or

(2) If continued flight in VFR conditions is not possible, the noninstrument rated pilot should so advise the controller and indicating the lack of an instrument rating, declare a *distress* condition, or

(3) If the pilot is instrument rated and current, and the aircraft is instrument equipped, the pilot should so indicate by requesting an IFR flight clearance. Assistance will then be provided on the basis that the aircraft can operate safely in IFR weather conditions.

451. TRANSPONDER EMERGENCY OPERATION

a. When a *distress* or *urgency* condition is encountered, the pilot of an aircraft with a coded radar beacon transponder, who desires to alert a ground radar facility, should squawk MODE 3/A, Code 7700/Emergency and MODE C altitude reporting and then immediately establish communications with the ATC facility.

b. Radar facilities are equipped so that Code 7700 normally triggers an alarm or special indicator at all control positions. Pilots should understand that they might not be within a radar coverage area. Therefore, they should continue squawking Code 7700 and establish radio communications as soon as possible.

452. DIRECTION FINDING INSTRUMENT APPROACH PROCEDURE

a. DF equipment has long been used to locate lost aircraft and to guide aircraft to areas of good weather or to airports. Now at most DF equipped airports, DF instrument approaches may be given to aircraft in a *distress* or *urgency* condition.

b. Experience has shown that most emergencies requiring DF assistance involve pilots with little flight experience. With this in mind, DF approach procedures provide maximum flight stability in the approach by using small turns, and wings-level descents. The DF specialist will give the pilot headings to fly and tell the pilot when to begin descent.

c. DF IAPs are for emergency use only and will not be used in IFR weather conditions unless the pilot has declared a *distress* or *urgency* condition.

d. To become familiar with the procedures and other benefits of DF, pilots are urged to request practice DF guidance and approaches in VFR weather conditions. DF specialists welcome the practice and will honor such requests, workload permitting.

453. INTERCEPT AND ESCORT

a. The concept of airborne intercept and escort is based on the Search and Rescue (SAR) aircraft establishing visual and/or electronic contact with an aircraft in difficulty, providing in-flight assistance, and escorting it to a safe landing. If bailout, crash landing or ditching becomes necessary, SAR operations can be conducted without delay. For most incidents, particularly those occurring at night and/or during instrument flight conditions, the availability of intercept and escort services will depend on the proximity of SAR units with suitable aircraft on alert for immediate dispatch. In limited circumstances, other aircraft flying in the vicinity of an aircraft in difficulty can provide these services.

b. If specifically requested by a pilot in difficulty or if a *distress* condition is declared, SAR coordinators *will* take steps to intercept and escort an aircraft. Steps *may* be initiated for intercept and escort if an *urgency* condition is declared and unusual circumstances make such action advisable.

c. It is the pilot's prerogative to refuse intercept and escort services. Escort services will normally be provided to the nearest adequate airport. Should the pilot receiving escort services continue onto another location after reaching a safe airport, or decide not to divert to the nearest safe airport, the escort aircraft is not obligated to continue and further escort is discretionary. The decision will depend on the circumstances of the individual incident.

454. EMERGENCY LOCATOR TRANSMITTERS

a. GENERAL. Emergency Locator Transmitters (ELTS) are required for most general aviation airplanes (FAR—91.52). ELTs of various types have been developed as a means of locating downed aircraft. These electronic, battery operated transmitters emit a distinctive downward swept audio tone on 121.5 MHz and 243.0 MHz. If "armed" and when subject to crash generated forces they are designed to automatically activate and continuously emit these signals. The transmitters will operate continuously for at least 48 hours over a wide temperature range. A properly installed and maintained ELT can expedite search and rescue operations and save lives.

b. TESTING. ELTs should be tested in accordance with the manufacturer's instructions, preferably in a shielded or screened room to prevent the broadcast of signals which could trigger a false alert. When this cannot be done, aircraft operational testing is authorized on 121.5 MHz and 243.0 MHz as follows:

(1) Tests should be conducted only during the first 5 minutes after any hour. If operational tests must be made outside of this time-frame, they should be coordinated with the nearest FAA Control Tower or FSS.

(2) Tests should be no longer than three audible sweeps.

(3) If the antenna is removable, a dummy load should be substituted during test procedures.

(4) Airborne tests are not authorized.

c. FALSE ALARMS. Caution should be exercised to prevent the inadvertent activation of ELTs in the air or while they are being handled on the ground. Accidental or unauthorized activation will generate an emergency signal that cannot be distinguished from the real thing, leading to expensive and frustrating searches. A false ELT signal could also interfere with genuine emergency transmissions and hinder or prevent the timely location of crash sites. Frequent false alarms could also result in complacency and decrease the vigorous reaction that must be attached to all ELT signals. Numerous cases of inadvertent activation have occurred as a result of aerobatics, hard landings, movement by ground crews and aircraft maintenance. These false alarms can be minimized by monitoring 121.5 MHz and/or 243.0 MHz as follows:

(1) In flight when a receiver is available.

(2) Prior to engine shut down at the end of each flight.

(3) When the ELT is handled during installation or maintenance.

(4) When maintenance is being performed in the vicinity of the ELT.

(5) When the aircraft is moved by a ground crew.

(6) If an ELT signal is heard, turn off the ELT to determine if it is transmitting. If it has been activated, maintenance might be required before the unit is returned to the "ARMED" position.

d. IN-FLIGHT MONITORING AND REPORTING. Pilots are encouraged to monitor 121.5 MHz and/or 243.0 MHz while in-flight to assist in identifying possible emergency ELT transmissions. On receiving a signal, report the following information to the nearest air traffic facility:

(1) Your position at the time the signal was first heard.

(2) Your position at the time the signal was last heard.

(3) Your position at maximum signal strength.

(4) Your flight altitudes and frequency on which the emergency signal was heard - 121.5 MHz or 243.0 MHz. If possible, positions should be given relative to a navigation aid. If the aircraft has homing equipment, provide the bearing to the emergency signal with each reported position.

455. FAA SPONSORED EXPLOSIVES DETECTION (DOG/HANDLER TEAM) LOCATIONS

a. At many of our major airports a program has been established by the FAA to make available explosives detection dog/handler teams. The dogs are trained by the Air Force and the overall program is run by FAA's Office of Civil Aviation Security. Local police departments are the caretakers of the dogs and are allowed to use the dogs in their normal police patrol functions. The local airport, however, has first call on the teams' services. The explosives detection teams were established so that no aircraft in flight is more than 1 hour from an airport at which it can be searched if a bomb threat is received. The following list contains those locations that presently have a team in existence. This list will be updated as more teams are established. If you desire this service, notify your company or an FAA facility.

b. Team Locations:

Airport Symbol	Location
ATL	Atlanta, Georgia
BWI	Baltimore, Maryland
BHM	Birmingham, Alabama
BIS	Bismarck, North Dakota
BOS	Boston, Massachusetts
BUF	Buffalo, New York
ORD	Chicago, Illinois
CLE	Cleveland, Ohio
DFW	Dallas, Texas
IAH	Houston, Texas
JAX	Jacksonville, Florida
MCI	Kansas City, Missouri

Airport Symbol	Location
LAX	Los Angeles, California
MEM	Memphis, Tennessee
MIA	Miami, Florida
MSY	New Orleans, Louisiana
PHX	Phoenix, Arizona
PIT	Pittsburgh, Pennsylvania
PDX	Portland, Oregon
SLC	Salt Lake City, Utah
SAN	San Diego, California
SFO	San Francisco, California
SJU	San Juan, Puerto Rico
SEA	Seattle, Washington
GEG	Spokane, Washington
STL	St. Louis, Missouri
TUS	Tucson, Arizona
TUL	Tulsa, Oklahoma

c. If due to weather or other considerations an aircraft with a suspected hidden explosive problem were to land or intended to land at an airport other than those listed in b. above, it is recommended that they call the FAA's Washington Operations Center (telephone 202-426-3333, if appropriate) or have an air traffic facility with which you can communicate contact the above center requesting assistance.

456. SEARCH AND RESCUE

a. GENERAL. SAR is a lifesaving service provided through the combined efforts of the federal agencies signatory to the National SAR Plan, and the agencies responsible for SAR within each state. Operational resources are provided by the U.S. Coast Guard, DOD components, the Civil Air Patrol, the Coast Guard Auxiliary, state, county and local law enforcement and other public safety agencies, and private volunteer organizations. Services include search for missing aircraft, survival aid, rescue, and emergency medical help for the occupants after an accident site is located.

b. NATIONAL SEARCH AND RESCUE PLAN. By federal interagency agreement, the National Search and Rescue Plan provides for the effective use of all available facilities in all types of SAR missions. These facilities include aircraft, vessels, pararescue and ground rescue teams, and emergency radio fixing. Under the Plan, the U.S. Coast Guard is responsible for the coordination of SAR in the Maritime Region, and the USAF is responsible in the Inland Region. To carry out these responsibilities, the Coast Guard and the Air Force have established Rescue Coordination Centers (RCCs) to direct SAR activities within their Regions. For aircraft emergencies, distress and urgency information normally will be passed to the appropriate RCC through an ARTCC or FSS.

c. COAST GUARD RESCUE COORDINATION CENTERS

Boston, MA
617-223-3644

New York, NY
212-668-7055

Long Beach, CA
213-590-2225

San Francisco, CA
415-437-3700

Portsmouth, VA
804-398-6231

Miami, FL
305-350-5611

New Orleans, LA
504-589-6225

Cleveland, OH
216-522-3984

St. Louis, MO
314-425-4614

Seattle, WA
206-442-5886

Juneau, AK
907-586-7340

Honolulu, HI
808-546-7109

Kodiak, AK
907-487-5888

San Juan, Puerto Rico
809-722-2943

d. AIR FORCE RESCUE COORDINATION CENTERS

Air Force Rescue Coordination Center - 48 Contiguous States

Scott AFB, Illinois	PHONE
Commercial	618-256-4815
WATS	800-851-3051
AUTOVON	638-4815
FTS	255-4815 or 4810

Alaskan Air Command Rescue Coordination Center - Alaska

Elmendorf AFB, Alaska	PHONE
Commercial	907-552-5375
AUTOVON	552-5375 or 2426

e. JOINT RESCUE COORDINATION CENTERS

Honolulu Joint Rescue Coordination Center - Hawaii

HQ 14th Coast Guard District Honolulu	PHONE
Commercial	808-531-1112
AUTOVON	315-421-4845

f. OVERDUE AIRCRAFT.

(1) ARTCCs and FSSs will alert the SAR system when information is received from any source that an aircraft is in difficulty, overdue, or missing. *A filed flight plan is the most timely and effective indicator that an air-*

craft is overdue. Flight plan information is invaluable to SAR forces for search planning and executing search efforts.

(2) Prior to departure on every flight, local or otherwise, someone at the departure point should be advised of your destination and route of flight if other than direct. Search efforts are often wasted and rescue is often delayed because of pilots who thoughtlessly takeoff without telling anyone where they are going. File a flight plan for *your* safety.

(3) According to the National Search and Rescue Plan, "The life expectancy of an injured survivor decreases as much as 80 percent during the first 24 hours, while the chances of survival of uninjured survivors rapidly diminishes after the first 3 days."

(4) An Air Force Review of 325 SAR missions conducted during a 23-month period revealed that "Time works against people who experience a *distress* but are not on a flight plan, since 36 hours normally pass before family concern initiates an (alert)."

g. VFR SEARCH AND RESCUE PROTECTION.

(1) To receive this valuable protection, *file a VFR Flight Plan* with an FAA FSS. For maximum protection, file only to the point of first intended landing, and refile for each leg to final destination. When a lengthy flight plan is filed, with several stops en route and an ETE to final destination, a mishap could occur on any leg, and unless other information is received, it is probably that no one would start looking for you until 30 minutes after your ETA at your final destination.

(2) If you land at a location other than the intended destination, report the landing to the nearest FAA FSS and advise them of your original destination.

(3) If you land en route and are delayed more than 30 minutes, report this information to the nearest FSS and give them your original destination.

(4) If your ETE changes by 30 minutes or more, report a revised ETE to the nearest FSS and give them your original destination. Remember that if you fail to report within one-half hour after your ETA at final destination, a search will be started to locate you.

(5) It is important that you *close your flight plan IMMEDIATELY AFTER ARRIVAL AT YOUR FINAL DESTINATION WITH THE FSS DESIGNATED WHEN YOUR FLIGHT PLAN WAS FILED. The pilot is responsible for closure of a VFR flight plan; they are not closed automatically.* This will prevent needless search efforts.

(6) The rapidity of rescue on land or water will depend on how accurately your position may be determined. If a flight plan has been followed and your position is on course, rescue will be expedited.

h. SURVIVAL EQUIPMENT.

(1) For flight over uninhabited land areas, it is wise to take and know how to use survival equipment for the type of climate and terrain.

(2) If a forced landing occurs at sea, chances for survival are governed by the degree of crew proficiency in emergency procedures and by the availability and effectiveness of water survival equipment.

i. OBSERVANCE OF DOWNED AIRCRAFT.

(1) Determine if crash is marked with a yellow cross; if so, the crash has already been reported and identified.

(2) If possible, determine type and number of aircraft and whether there is evidence of survivors.

(3) Fix the position of the crash as accurately as possible with reference to a navigational aid. If possible provide geographic or physical description of the area to aid ground search parties.

(4) Transmit the information to the nearest FAA or other appropriate radio facility.

(5) If circumstances permit, orbit the scene to guide in other assisting units until their arrival or until you are relieved by another aircraft.

(6) Immediately after landing, make a complete report to the nearest FAA facility, or Air Force or Coast Guard Rescue Coordination Center. The report can be made by long distance collect telephone.

457—459. RESERVED

GROUND-AIR VISUAL CODE FOR USE BY SURVIVORS

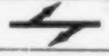
NO.	MESSAGE	CODE SYMBOL
1	Require assistance	V
2	Require medical assistance	X
3	No or Negative	N
4	Yes or Affirmative	Y
5	Proceeding in this direction	↑

IF IN DOUBT, USE INTERNATIONAL SYMBOL **S O S**

INSTRUCTIONS

1. Lay out symbols by using strips of fabric or parachutes, pieces of wood, stones, or any available material.
2. Provide as much color contrast as possible between material used for symbols and background against which symbols are exposed.
3. Symbols should be at least 10 feet high or larger. Care should be taken to lay out symbols exactly as shown.
4. In addition to using symbols, every effort is to be made to attract attention by means of radio, flares, smoke, or other available means.
5. On snow covered ground, signals can be made by dragging, shoveling or tramping. Depressed areas forming symbols will appear black from the air.
6. Pilot should acknowledge message by rocking wings from side to side.

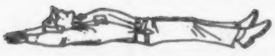
GROUND-AIR VISUAL CODE FOR USE BY GROUND SEARCH PARTIES

NO.	MESSAGE	CODE SYMBOL
1	Operation completed.	LLL
2	We have found all personnel.	$\underline{\text{LL}}$
3	We have found only some personnel.	╫
4	We are not able to continue. Returning to base.	XX
5	Have divided into two groups. Each proceeding in direction indicated.	
6	Information received that aircraft is in this direction.	—→
7	Nothing found. Will continue search.	NN

"Note: These visual signals have been accepted for international use and appear in Annex 12 to the Convention on International Civil Aviation."

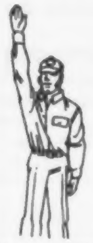
EMERGENCY SERVICES AVAILABLE TO PILOTS

VISUAL EMERGENCY SIGNALS



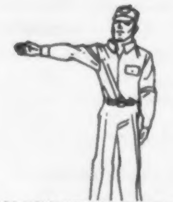
NEED MEDICAL ASSISTANCE–URGENT

Used only when life is at stake



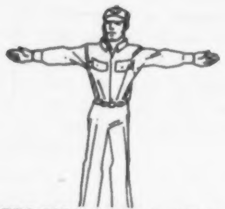
ALL OK–DO NOT WAIT

Wave one arm overhead



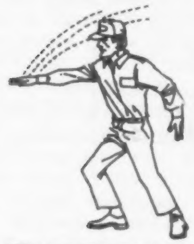
CAN PROCEED SHORTLY–WAIT IF PRACTICABLE

One arm horizontal



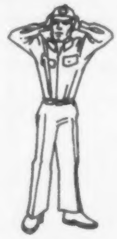
NEED MECHANICAL HELP OR PARTS–LONG DELAY

Both arms horizontal



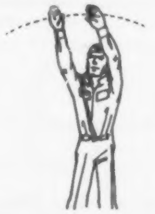
USE DROP MESSAGE

Make throwing motion



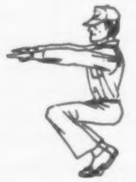
OUR RECEIVER IS OPERATING

Cup hands over ears



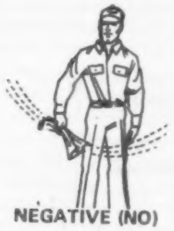
DO NOT ATTEMPT TO LAND HERE

Both arms waved across face



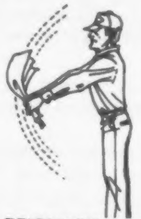
LAND HERE

Both arms forward horizontally, squatting and point in direction of landing–Repeat



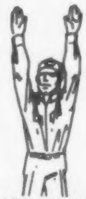
NEGATIVE (NO)

White cloth waved horizontally



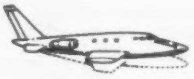
AFFIRMATIVE (YES)

White cloth waved vertically



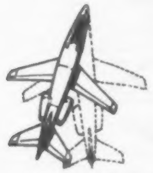
PICK US UP–PLANE ABANDONED

Both arms vertical



AFFIRMATIVE (YES)

Dip nose of plane several times



NEGATIVE (NO)

Fishtail plane

HOW TO USE THEM

If you are forced down and are able to attract the attention of the pilot of a rescue airplane, the body signals illustrated on this page can be used to transmit messages to him as he circles over your location. Stand in the open when you make the signals. Be sure that the background, as seen from the air, is not confusing. Go through the motions slowly and repeat each signal until you are positive that the pilot understands you.

Section 3. DISTRESS AND URGENCY PROCEDURES

460. DISTRESS AND URGENCY COMMUNICATIONS

a. A pilot who encounters a *distress* or *urgency* condition can obtain assistance simply by contacting the air traffic facility or other agency in whose area of responsibility the aircraft is operating, stating the nature of the difficulty, pilot's intentions and assistance desires. *Distress* and *urgency* communications procedures are prescribed by the International Civil Aviation Organization (ICAO), however, and have decided advantages over the informal procedure described above.

b. *Distress* and *urgency* communications procedures discussed in the following paragraphs relate to the use of air ground voice communications.

c. The initial communication, and if considered necessary, any subsequent transmissions by an aircraft in *distress* should begin with the signal MAYDAY, preferably repeated three times. The signal PAN-PAN should be used in the same manner for an *urgency* condition.

d. *Distress* communications have absolute priority over all other communications, and the word MAYDAY commands radio silence on the frequency in use. *Urgency* communications have priority over all other communications except *distress*, and the word PAN-PAN warns other stations not to interfere with *urgency* transmissions.

e. Normally, the station addressed will be the air traffic facility or other agency providing air traffic services, on the frequency in use at the time. If the pilot is not communicating and receiving services, the station to be called will normally be the air traffic facility or other agency in whose area of responsibility the aircraft is operating, on the appropriate assigned frequency. If the station addressed does not respond, or if time or the situation dictates, the *distress* or *urgency* message may be broadcast, or a collect call may be used, addressing "Any Station (Tower)(Radio)(Radar)."

f. The station addressed should immediately acknowledge a *distress* or *urgency* message, provide assistance, coordinate and direct the activities of assisting facilities, and alert the appropriate search and rescue coordinator if warranted. Responsibility will be transferred to another station only if better handling will result.

g. All other stations, aircraft and ground, will continue to listen until it is evident that assistance is being provided. If any station becomes aware that the station being called either has not received a *distress* or *urgency* message, or cannot communicate with the aircraft in difficulty, it will attempt to contact the aircraft and provide assistance.

h. Although the frequency in use or other frequencies assigned by ATC are preferable, the following emergency frequencies can be used for distress or urgency communications, if necessary or desirable:

(1) 121.5 MHz and 243.0 MHz - Both have a range generally limited to line of sight. 121.5 MHz is guarded by direction finding stations and some military and civil aircraft. 243.0 MHz is guarded by military aircraft. Both 121.5 MHz and 243.0 MHz are guarded by military towers, most civil towers, FSSs, and radar facilities. Normally ARTCC emergency frequency capability does not extend to radar coverage limits. If an ARTCC does not respond when called on 121.5 MHz or 243.0 MHz, call the nearest tower or FSS.

(2) 2182 kHz - The range is generally less than 300 miles for the average aircraft installation. It can be used to request assistance from stations in the maritime service. 2182 kHz is guarded by major radio stations serving Coast Guard Rescue Coordination Centers, and Coast Guard units along the sea coasts of the U.S. and shores of the Great Lakes. The call "Coast Guard" will alert all Coast Guard Radio Stations within range. 2182 kHz is also guarded by most commercial coast stations and some ships and boats.

461. OBTAINING EMERGENCY ASSISTANCE

a. A pilot in any *distress* or *urgency* condition should *immediately* take the following action, not necessarily in the order listed, to obtain assistance:

(1) Climb, if possible, for improved communications, and better radar and direction finding detection. However, it must be understood that unauthorized climb or descent under IFR conditions within controlled airspace is prohibited, except as permitted by FAR—91.3(b).

(2) If equipped with a radar beacon transponder (civil) or IFF/SIF (military):

(a) Continue squawking assigned MODE A/3 discrete code/VFR code and MODE C altitude encoding when in radio contact with an air traffic facility or other agency providing air traffic services, unless instructed to do otherwise.

(b) If unable to immediately establish communications with an air traffic facility/agency, squawk MODE A/3, Code 7700/Emergency and MODE C.

(3) Transmit a *distress* or *urgency* message consisting of *as many as necessary* of the following elements, preferably in the order listed:

(a) If distress, MAYDAY, MAYDAY, MAYDAY; if *urgency*, PAN-PAN, PAN-PAN, PAN-PAN.

(b) Name of station addressed.

(c) Aircraft identification and type.

(d) Nature of *distress* or *urgency*.

(e) Weather.

(f) Pilots intentions and request.

(g) Present position, and heading, or if *lost*, last known position, time, and heading since that position.

(h) Altitude or flight level.

(i) Fuel remaining in hours and minutes.

(j) Number of people on board.

(k) Any other useful information.

b. After establishing radio contact, comply with advice and instructions received. Cooperate. Do not hesitate to ask questions or clarify instructions when you do not understand or if you cannot comply with clearance. Assist the ground station to control communications on the frequency in use. Silence interfering radio stations. Do not change frequency or change to another ground station unless absolutely necessary. If you do, advise the ground station of the new frequency and station name prior to the change, transmitting in the blind if necessary. If two-way communications cannot be established on the new frequency, return immediately to the frequency or station where two-way communications last existed.

c. When in a distress condition with bailout, crash landing or ditching imminent, take the following additional actions to assist search and rescue units:

(1) Time and circumstances permitting, transmit as many as necessary of the message elements in PARA—461a(3) and any of the following that you think might be helpful:

(a) ELT status.

(b) Visible landmarks.

(c) Aircraft color.

(d) Number of persons on board.

(e) Emergency equipment on board.

(2) Actuate your ELT if the installation permits.

(3) For bailout, and for crash landing or ditching if risk of fire is not a consideration, set your radio for continuous transmission.

(4) If it becomes necessary to ditch, make every effort to ditch near a surface vessel. If time permits, an FAA facility should be able to get the position of the nearest commercial or Coast Guard vessel from a Coast Guard Rescue Coordination Center.

(5) After a crash landing unless you have good reason to believe that you will not be located by search aircraft or ground teams, it is best to remain with your aircraft and prepare means for signalling search aircraft.

462. DITCHING PROCEDURES

a. A successful aircraft ditching is dependent on three primary factors. In order of importance they are:

(1) Sea conditions and wind.

(2) Type of aircraft.

(3) Skill and technique of pilot.

b. Common oceanographic terminology:

(1) Sea. The condition of the surface that is the result of both waves and swells.

(2) Wave (or Chop). The condition of the surface caused by the local winds.

(3) Swell. The condition of the surface which has been caused by a distance disturbance.

(4) Swell Face. The side of the swell toward the observer. The backside is the side away from the observer. These definitions apply regardless of the direction of swell movement.

(5) Primary Swell. The swell system having the greatest height from trough to crest.

(6) Secondary Swells. Those swell systems of less height than the primary swell.

(7) Fetch. The distance the waves have been driven by a wind blowing in a constant direction, without obstruction.

(8) Swell Period. The time interval between the passage of two successive crests at the same spot in the water, measured in seconds.

(9) Swell Velocity. The speed and direction of the swell with relation to a fixed reference point, measured in knots. There is little movement of water in the horizontal direction. Swells move primarily in a vertical motion, similar to the motion observed when shaking out a carpet.

(10) Swell Direction. The direction *from* which a swell is moving. This direction is not necessarily the result of the wind present at the scene. The swell may be moving into or across the local wind. Swells, once set in motion, tend to maintain their original direction for as long as they continue in deep water, regardless of changes in wind direction.

(11) Swell Height. The height between crest and trough, measured in feet. The vast majority of ocean swells are lower than 12 to 15 feet, and swells over 25 feet are not common at any spot on the oceans. Successive swells may differ considerably in height.

c. In order to select a good heading when ditching an aircraft, a basic evaluation of the sea is required. Selection of a good ditching heading may well minimize damage and could save your life. It can be extremely dangerous to land into the wind without regard to sea conditions; the swell system, or systems, must be taken into consideration. Remember one axiom - AVOID THE FACE OF A SWELL.

(1) In ditching parallel to the swell, it makes little difference whether touchdown is on the top of the crest or in the trough. It is preferable, however, to land on the top or back side of the swell, if possible. After determining which heading (and its reciprocal) will parallel the swell, select the heading with the most into the wind component.

(2) If only one swell system exists, the problem is relatively simple - even with a high, fast system. Unfortunately, most cases involve two or more swell systems running in different directions. With more than one system present, the sea presents a confused appearance. One of the most difficult situations occurs when two swell systems are at right angles. For example, if one system is eight feet high and the other three feet, plan to land parallel to the primary system, and on the down swell of the secondary system. If both systems are of equal height, a compromise may be advisable - select an intermediate heading at 45 degrees down swell to both systems. When landing down a secondary swell, attempt to touch down on the back side, not on the face of the swell.

(3) *If the swell system is formidable, it is considered advisable, in landplanes, to accept more crosswind in order to avoid landing directly into the swell.*

(4) The secondary swell system is often from the same direction as the wind. Here, the landing may be made parallel to the primary system, with the wind and secondary system at an angle. There is a choice to two directions paralleling the primary system. One direction is downwind and down the secondary swell, and the other is into the wind and into the secondary swell, the choice will depend on the velocity of the wind versus the velocity and height of the secondary swell.

d. The simplest method of estimating the wind direction and velocity is to examine the windstreaks on the water. These appear as long streaks up and down wind. Some persons may have difficulty determining wind direction after seeing the streaks on the water. Whitecaps fall forward with the wind but are overrun by the waves thus producing the illusion that the foam is sliding backward. Knowing this, and by observing the direction of the streaks, the wind direction is easily determined. Wind velocity can be estimated by noting the appearance of the whitecaps, foam and wind streaks.

(1) The behavior of the aircraft on making contact with the water will vary within wide limits according to the state of the sea. If landed parallel to a single swell system, the behavior of the aircraft may approximate that to be expected on a smooth sea. If landed into a heavy swell or into a confused sea, the deceleration forces may be extremely great - resulting in breaking up of the aircraft. Within certain limits, the pilot is able to minimize these forces by proper sea evaluation and selection of ditching heading.

(2) When on final approach the pilot should look ahead and observe the surface of the sea. There may be shadows and whitecaps - signs of large seas. Shadows and whitecaps close together indicate short and rough seas. Touchdown in these areas is to be avoided. Select and touchdown in any area (only about 500 feet is needed) where the shadows and whitecaps are not so numerous.

(3) Touchdown should be at the *lowest* speed and rate of descent which permit safe handling and optimum nose up attitude on impact. Once first impact has been made, there is often little the pilot can do to control a landplane.

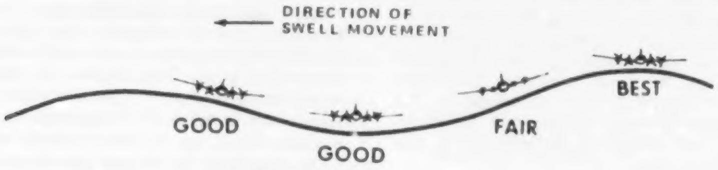
e. Once preditching preparations are completed, the pilot should turn to the ditching heading and commence let-down. The aircraft should be flown low over the water, and slowed down until ten knots or so above stall. At this point, additional power should be used to overcome the increased drag caused by the nose up attitude. When a smooth stretch of water appears ahead, cut power, and touchdown at the best recommended speed as fully stalled as possible. By cutting power when approaching a relatively smooth area, the pilot will prevent overshooting and will touchdown with less chance of planing off into a second uncontrolled landing. Most experienced seaplane pilots prefer to make contact with the water in a semi-stalled attitude, cutting power as the tail makes contact. This technique eliminates the chance of misjudging altitude with a resultant heavy drop in a fully stalled condition. Care must be taken not to drop the aircraft from too high altitude or to balloon due to excessive speed. The altitude above water depends on the aircraft. Over glassy smooth water, or at night without sufficient light, it is very easy, for even the most experienced pilots to misjudge altitude by 50 feet or more. Under such conditions, carry enough power to maintain nine to twelve degrees nose up attitude, and 10 to 20 percent over stalling speed until contact is made with the water. The proper use of power on the approach is of great importance. If power is available on one side only, a little power should be used to flatten the approach; however, the engine should not be used to such an extent that the aircraft cannot be turned against the good engines right down to the stall with a margin of rudder movement available. When near the stall, sudden application of excessive unbalanced power may result in loss of directional control. If power is available on one side only, a slightly higher than normal glide approach speed should be used. This will insure good control and some margin of speed after leveling off without excessive use of power. The use of power in ditching is so important that when it is certain that the coast cannot be reached, the pilot should, if possible, ditch before fuel is exhausted. The use of power in a night or instrument ditching is far more essential than under daylight contact conditions.

(1) If no power is available, a greater than normal approach speed should be used down to the flare-out. This speed margin will allow the glide to be broken early and more gradually, thereby giving the pilot time and distance to feel for the surface - decreasing the possibility of stalling high or flying into the water. When landing parallel to a swell system, little difference is noted between landing on top of a crest or in the trough. If the wings of aircraft are trimmed to the surface of the sea rather than the horizon, there is little need to worry about a wing hitting a swell crest. The actual slope of a swell is very gradual. If forced to land into a swell, touchdown should be made just after passage of the crest. If contact is made on the face of the swell, the aircraft may be swamped or thrown violently into the air, dropping heavily into the next swell. If control surfaces remain intact, the pilot should attempt to maintain the proper nose above the horizon attitude by rapid and positive use of the controls.

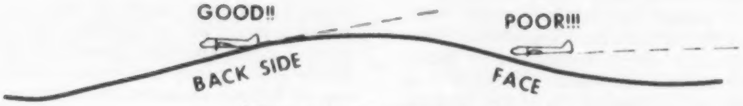
f. After Touchdown: In most cases drift, caused by crosswind can be ignored; the forces acting on the aircraft after touchdown are of such magnitude that drift will be only a secondary consideration. If the aircraft is under good control, the "crab" may be kicked out with rudder just prior to touchdown. This is more important with high wing aircraft, for they are laterally unstable on the water in a crosswind and may roll to the side in ditching.

NOTE.— This information has been extracted from Appendix H of the "National Search And Rescue Manual."

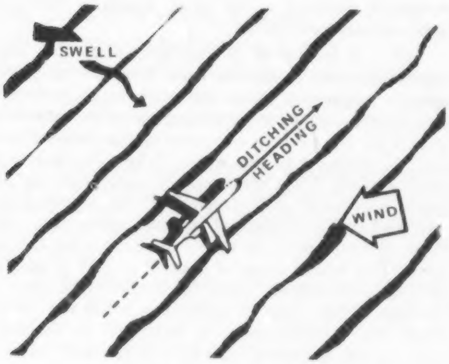
WIND-SWELL-DITCH HEADING SITUATIONS


DIRECTION OF SWELL MOVEMENT
GOOD
GOOD
FAIR
BEST

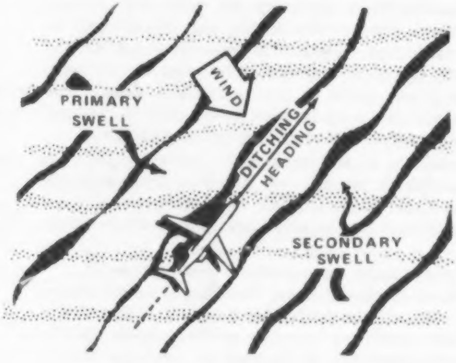
Landing parallel to the major swell


GOOD!!
POOR!!!
BACK SIDE
FACE

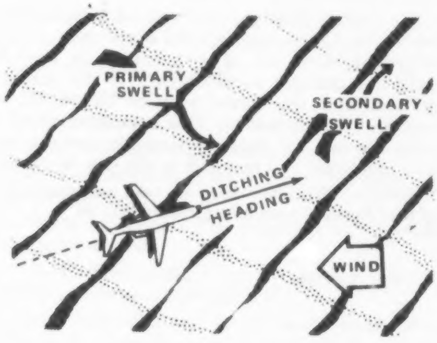
Landing on the face and back of swell


SWELL
DITCHING HEADING
WIND

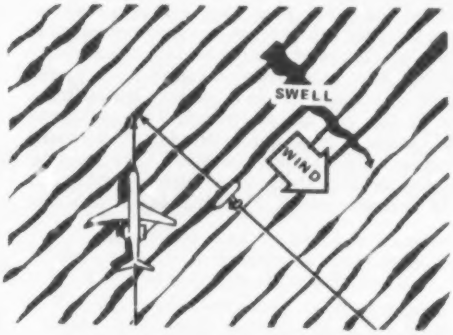
Single Swell System - Wind 15 knots


PRIMARY SWELL
WIND
DITCHING HEADING
SECONDARY SWELL

Double Swell System - Wind 15 knots


PRIMARY SWELL
SECONDARY SWELL
DITCHING HEADING
WIND

Double Swell System - Wind 30 knots



Wind - 50 knots

Aircraft with low landing speeds - land into the wind.

Aircraft with high landing speeds - choose compromise heading between wind and swell.

Both - Land on back side of swell.

463. SPECIAL EMERGENCY (AIR PIRACY)

a. A special emergency is a condition of air piracy, or other hostile act by a person(s) aboard an aircraft, which threatens the safety of the aircraft or its passengers.

b. The pilot of an aircraft reporting a special emergency condition should:

(1) If circumstances permit, apply *distress or urgency* radio-telephony procedures (see PARA—460). Include the details of the special emergency.

(2) If circumstances do not permit the use of prescribed *distress* or *urgency* procedures, transmit:

(a) On the air/ground frequency in use at the time.

(b) As many as possible of the following elements spoken distinctly and in the following order:

1. Name of the station addressed (time and circumstances permitting).

2. The identification of the aircraft and present position.

3. The nature of the special emergency condition and pilot intentions (circumstances permitting).

4. If unable to provide this information, use code words and/or transponder as follows: state "TRANSPONDER SEVEN FIVE ZERO ZERO". Meaning: "I am being hijacked/forced to a new destination"; and/or use Transponder Setting MODE 3/A, Code 7500.

NOTE.— Code 7500 will never be assigned by ATC without prior notification from the pilot that his aircraft is being subjected to unlawful interference. The pilot should refuse the assignment of Code 7500 in any other situation and inform the controller accordingly. Code 7500 will trigger the special emergency indicator in all radar ATC facilities.

c. Air traffic controllers will acknowledge and confirm receipt of transponder Code 7500 by asking the pilot to verify it. If the aircraft is not being subjected to unlawful interference, the pilot should respond to the query by broadcasting in the clear that he is not being subjected to unlawful interference. Upon receipt of this information, the controller will request the pilot to verify the code selection depicted in the code selector windows in the transponder control panel and change the code to the appropriate setting. If the pilot replies in the affirmative or does not reply, the controller will not ask further questions but will flight follow, respond to pilot requests and notify appropriate authorities.

d. If it is possible to do so without jeopardizing the safety of the flight, the pilot of a hijacked passenger aircraft, after departing from the cleared routing over which the aircraft was operating, will attempt to do one or more of the following things, insofar as circumstances may permit:

(1) Maintain a true airspeed of no more than 400 knots, and preferably an altitude of between 10,000 and 25,000 feet.

(2) Fly a course toward the destination which the hijacker has announced.

e. If these procedures result in either radio contact or air intercept, the pilot will attempt to comply with any instructions received which may direct him to an appropriate landing field.

464. FUEL DUMPING

a. Should it become necessary to dump fuel, the pilot should immediately advise ATC. Upon receipt of information that an aircraft will dump fuel, ATC will broadcast or cause to be broadcast immediately and every 3 minutes thereafter the following on appropriate ATC and FSS radio frequencies:

EXAMPLE:

ATTENTION ALL AIRCRAFT — FUEL DUMPING IN PROGRESS OVER — (location) AT (altitude) BY (type aircraft) (flight direction).

b. Upon receipt of such a broadcast, pilots of aircraft affected, which are not on IFR flight plans or special VFR clearances, should clear the area specified in the advisory. Aircraft on IFR flight plans or special VFR clearances will be provided specific separation by ATC. At the termination of the fuel dumping operation, pilots should advise ATC. Upon receipt of such information, ATC will issue, on the appropriate frequencies, the following:

EXAMPLE:

ATTENTION ALL AIRCRAFT — FUEL DUMPING BY — (type aircraft) — TERMINATED.

465—469. RESERVED

NOTES

Section 4. TWO-WAY RADIO COMMUNICATIONS FAILURE

470. TWO-WAY RADIO COMMUNICATIONS FAILURE

a. It is virtually impossible to provide regulations and procedures applicable to all possible situations associated with two-way radio communications failure. During two-way radio communications failure, when confronted by a situation not covered in the regulation, pilots are expected to exercise good judgment in whatever action they elect to take. Should the situation so dictate they should not be reluctant to use the emergency action contained in FAR—91.3(b).

b. Whether two-way communications failure constitutes an emergency depends on the circumstances, and in any event, it is a determination made by the pilot. FAR—91.3(b) authorizes a pilot to deviate from any rule in Subparts A and B to the extent required to meet an emergency.

c. In the event of two-way radio communications failure, ATC service will be provided on the basis that the pilot is operating in accordance with FAR—91.127. A pilot experiencing two-way communications failure should (unless emergency authority is exercised) comply with FAR—91.127 quoted below. Capitalization and examples added for emphasis.

"91.127 IFR operations; two-way radio communications failure."

(1) General. Unless otherwise authorized by ATC, each pilot who has two-way radio communications failure when operating under IFR shall comply with the rules of this section.

(2) VFR conditions. If the failure occurs in VFR conditions, or if VFR conditions are encountered after the failure, each pilot shall continue the flight under VFR and land as soon as practicable.

NOTE.— This procedure also applies when two-way radio failure occurs while operating in Positive Control Airspace (PCA). The primary objective of this provision in FAR—91.127 is to preclude extended IFR operation in the ATC system in VFR weather conditions. Pilots should recognize that operation under these conditions may unnecessarily as well as adversely affect other users of the airspace, since ATC may be required to reroute or delay other users in order to protect the failure aircraft. However, it is not intended that the requirement to "land as soon as practicable" be construed to mean "as soon as possible." The pilot retains his prerogative of exercising his best judgment and is not required to land at an unauthorized airport, at an airport unsuitable for the type of aircraft flown, or to land only minutes short of his destination.

(3) IFR conditions. If the failure occurs in IFR conditions, or if paragraph (b) of this section cannot be complied with, each pilot shall continue the flight according to the following:

(a) Route.

1. By the route assigned in the last ATC clearance received;

2. If being radar vectored, by the direct route from the point of radio failure to the fix, route, or airway specified in the vector clearance;

3. In the absence of an assigned route, by the route that ATC has advised may be expected in a further clearance; or

4. In the absence of an assigned route or a route that ATC has advised may be expected in a further clearance by the route filed in the flight plan.

(b) Altitude. At the HIGHEST of the following altitudes or flight levels FOR THE ROUTE SEGMENT BEING FLOWN:

1. The altitude or flight level assigned in the last ATC clearance received;

2. The minimum altitude (converted, if appropriate, to minimum flight level as prescribed in FAR 91.81. (c)) for IFR operations; or

3. The altitude or flight level ATC has advised may be expected in a further clearance.

NOTE.— The intent of the rule is that a pilot who has experienced two-way radio failure should, during any segment of his route, fly at the appropriate altitude specified in the rule for that particular segment. The appropriate altitude is whichever of the three is highest in each given phase of flight: (1) the altitude or flight level last assigned; (2) the MEA or (3) the altitude or flight level the pilot has been advised to expect in a further clearance.

EXAMPLE:

A pilot with two-way radio failure had an assigned altitude of 7,000 feet, and while en route comes to a route segment for which the MEA was 9,000 feet. He would climb to 9,000 feet at the time or place where it became necessary to comply with the 9,000 feet MEA. (See FAR—91.119(b).) If later, while still proceeding to his destination, the MEA dropped from 9,000 feet to 5,000 feet, he would descend to *7,000 feet* (the last assigned altitude), because that altitude is *higher* than the MEA.

EXAMPLE:

The MEA between **A** and **B** —5,000 feet. The MEA between **B** and **C** —5,000 feet. The MEA between **C** and **D** —11,000 feet. The MEA between **D** and **E** —7,000 feet. A pilot had been cleared via **A, B, C, D,** to **E.** While flying between A and B his assigned altitude was 6,000 feet and he was told to expect a clearance to 8,000 feet at **B.** Prior to receiving the higher altitude assignment, he experienced two-way failure. The pilot would maintain 6,000 to **B,** then climb to 8,000 feet (the altitude he was advised to expect.) He would maintain 8,000 feet, then climb to 11,000 at **C,** or prior to **C** if necessary to comply with an MCA at **C.** (FAR—91.119(b)). Upon reaching **D,** the pilot would descend to *8,000 feet* (even though the MEA was 7,000 feet), as 8,000 was the highest of the altitude situations stated in the rule (FAR—91.127).

(c) Leave holding fix/clearance limit.

1. If an EFC time has been received, leave the clearance limit/holding fix at that time and proceed to and

hold, if necessary, at the holding pattern depicted for the IAP or, if none is depicted, at the fix from which the approach begins. Any additional delay information the pilot has received should not be used or considered in the application of two-way communications failure procedures.

2. If an EFC time has not been received, the pilot is expected to proceed to and hold, if necessary, at the holding pattern depicted for the IAP or, if none is depicted, at the fix from which the approach begins. If more than one approach fix is available, it is pilot choice and ATC protects airspace at all of them.

NOTE.— The phrase *fix from which the approach begins* means any initial approach fix, or point at which the procedure track symbol begins, as depicted on the plan view of the instrument approach procedure.

(d) Descent for approach.

1. Begin descent from the en route altitude or flight level upon reaching the fix from which the approach begins, but not before the estimated time of arrival shown on the flight plan as amended with ATC.

2. If holding is necessary at the radio fix to be used for the approach at the destination airport, holding and descent to the initial approach altitude shall be accomplished in a holding pattern in accordance with the pattern depicted on the approach chart. If no holding pattern is depicted, holding and descent will be accomplished in a holding pattern on the side of the final approach course on which the procedure turn is described.

471. TRANSPONDER OPERATION DURING TWO-WAY COMMUNICATIONS FAILURE

a. If a pilot of an aircraft with a coded radar beacon transponder experiences a loss of two-way radio capability he should:

(1) Adjust his transponder to reply on MODE A/3, Code 7700 for a period of 1 minute.

(2) Then change to Code 7600 and remain on 7600 for a period of 15 minutes or the remainder of the flight, whichever comes first.

(3) Repeat steps (1) and (2) as practicable.

b. The pilot should understand that he may not be in an area of radar coverage.

472. REESTABLISHING RADIO CONTACT

a. In addition to monitoring the NAVAID voice feature, the pilot should attempt to reestablish communications by attempting contact:

(1) on the previously assigned frequency, or

(2) with an FSS or *ARINC.

b. If communcations are established with an FSS or ARINC, the pilot should advise that radio communications on the previously assigned frequency has been lost giving the aircraft's position, altitude, last assigned frequency and then request further clearance from the controlling facility. The preceding does not preclude the use of 121.5 MHz. There is no priority on which action should be attempted first. If the capability exists, do all at the same time.

NOTE.— *AERONAUTICAL RADIO/INCORPORATED (ARINC) - is a commercial communications corporation which designs, constructs, operates, leases or otherwise engages in radio activities serving the aviation community. ARINC has the capability of relaying information to/from ATC facilities throughout the country.

473—499. RESERVED

Chapter 6. SAFETY OF FLIGHT

Section 1. METEOROLOGY

500. NATIONAL WEATHER SERVICE AVIATION PRODUCTS

a. Weather service to aviation is a joint effort of the National Weather Service (NWS), the Federal Aviation Administration (FAA), the military weather services, and other aviation oriented groups and individuals. The NWS maintains an extensive surface, upper air and radar weather observing program; a nationwide aviation weather forecasting service; and also provides pilot briefing service. The majority of pilot weather briefings are provided by FAA personnel at Flight Service Stations (FSSs). Surface weather observations are taken by the NWS and NWS certified FAA, contract and supplemental observers and by automated observing systems. (See paragraph 509)

b. Aviation forecasts are prepared by 52 Weather Service Forecast Offices (WSFOs). These offices prepare and distribute approximately 500 terminal forecasts 3 times daily for specific airports in 50 states and the Caribbean (4 times daily in Alaska and Hawaii). These forecasts, which are amended as required, are valid for 24 hours. The last 6 hours are given in categorical outlook terms as described in PARA—505. WSFOs also prepare a total of over 300 route forecasts and 39 synopses for Pilots Automatic Telephone Weather Answering Service (PATWAS), Transcribed Weather Broadcast (TWEB), and briefing purposes. The route forecasts that are issued during the morning and mid-day are valid for 12 hours while the evening issuance is valid for 18 hours. A new centralized aviation forecast program originating from the National Aviation Weather Advisory Unit (NAWAU) in Kansas City was implemented in November 1982. In the conterminous U.S., all In-flight Advisories (SIGMETs, convective SIGMETs, and AIRMETs) and all Area Forecasts (6 areas) are now issued by NAWAU. The Area Forecasts are prepared 3 times a day in the conterminous states (4 times in Hawaii), and amended as required, while In-flight Advisories are issued only when conditions warrant. (See PARA—504.) Winds aloft forecasts are provided for 176 locations in the 48 contiguous states and 21 in Alaska for flight planning purposes. (Winds aloft forecasts for Hawaii are prepared locally). All of the aviation weather forecasts are given wide distribution through the Weather Message Switching Center in Kansas City (WMSC).

501. FAA WEATHER SERVICES

a. The FAA maintains a nationwide network of Flight Service Stations (FSSs) to serve the weather needs of pilots. In addition, NWS meteorologists are assigned to most Air Route Traffic Control Centers (ARTCCs) as part of the Center Weather Service Unit (CWSU). They provide advisory service and short-term forecasts (nowcasts) to support the needs of the FAA and other users of the system.

b. The primary source of preflight weather briefings is an individual briefing obtained from a briefer at the FSS or NWS. These briefings, which are tailored to your specific flight, are available 24 hours a day through the local FSS or through the use of toll free lines (INWATS). Numbers for these services can be found in the Airport/ Facility Directory under the FAA and NWS Weather and Aeronautical Information Telephone Numbers section and the DOT, Federal Aviation Administration or Department of Commerce, National Weather Service listing under U.S. Government in your local telephone directory. See paragraph-502 for the types of preflight briefings available and the type of information contained in each. NWS pilot briefers do not provide aeronautical information (NOTAMs, flow control advisories, etc.) nor do they accept flight plans.

c. Other sources of weather information are as follows:

(1) The A.M. Weather telecast on the PBS television network is a jointly sponsored 15-minute weather program designed for pilots. It is broadcast Monday through Friday mornings. Check TV listings in your area for station and exact times.

(2) The Transcribed Weather Broadcast (TWEB), telephone access to the TWEB (TEL-TWEB) and Pilots Automatic Telephone Weather Answering Service (PATWAS) provide continuously updated recorded weather information for short or local flights. Separate paragraphs in this section give additional information regarding these services.

(3) The Interim Voice Response System (IVRS) is now available in 24 metropolitan areas. Using this system, a limited weather data base can be accessed through the use of a TOUCH-TONE® telephone. The IVRS provides weather information for the conterminous United States 24 hours a day. Six weather products are provided: Severe Weather Forecast Alerts (AWW), Convective Sigmets (WST), Surface Observations (SA), Terminal Forecasts (FT), Winds Aloft Forecasts (GF), and TWEB Route Forecasts (TR). Pilots should be aware that among the products not provided are non-convective SIGMETS, AIRMETS, and Center Weather Advisories (CWA). These issuances must be obtained from the FSS or other available sources to supplement the IVRS information for flight planning purposes. A 24 hour toll- free number (800-367-4877) is available to answer pilot questions, to explain system operation and to respond to any system problems. Detailed instructions on how to use IVRS are contained in *"A Pilot's Guide to IVRS"*. A copy can be obtained from any FAA Flight Standards District Office or Flight Service Station. Comments, questions and requests for additional information may be directed to: IVRS Project Office, Federal Aviation Administration, APM-230, Washington, D.C. 20591. Telephone numbers for IVRS facilities in individual metropolitan areas are listed in the Airport/Facility Directories under the FAA and NWS weather and Aeronautical Information Telephone Numbers section.

(4) Weather and aeronautical information is also available from numerous private industry sources on an individual or contract pay basis. Information on how to obtain this service should be available from local pilot organizations.

d. In-flight weather information is available from any FSS within radio range. See PARA-506 through PARA—508 for information on broadcasts. En route Flight Advisory Service (EFAS) is provided to serve the nonroutine weather needs of pilots in flight. See PARA—503 for details on this service.

502. PREFLIGHT BRIEFING

a. Flight Service Stations (FSSs) are the primary source for obtaining preflight briefings and in-flight weather information. In some locations, the Weather Service Office (WSO) provides preflight briefings on a limited basis. Flight Service Specialists are qualified and certificated by the NWS as Pilot Weather Briefers. They are not authorized to make original forecasts, but are authorized to translate and interpret available forecasts and reports directly into terms describing the weather conditions which you can expect along your flight route and at your destination. Available aviation weather reports and forecasts are displayed at each FSS and WSO. Some of the larger FSSs provide a separate display for pilot use. Pilots should feel free to use these self briefing displays where available, or to ask for a briefing or assistance from the specialist on duty. Three basic types of preflight briefings are available to serve your specific needs. These are: Standard Briefing, Abbreviated Briefing, and Outlook Briefing. You should specify to the briefer the type of briefing you want, along with appropriate background information. (Refer to PARA—290 for items that are required.) This will enable the briefer to tailor the information to your intended flight. The following paragraphs describe the types of briefings available and the information provided in each.

b. STANDARD BRIEFING—You should request a Standard Briefing any time you are planning a flight and you have not received a previous briefing or have not received preliminary information through mass dissemination media; e.g., TWEB, PATWAS, VRS, etc. The briefer will automatically provide the following information in the sequence listed, except as noted, when it is applicable to your proposed flight.

(1) Adverse Conditions—Significant meteorological and aeronautical information that might influence the pilot to alter the proposed flight, e.g., hazardous weather conditions, runway closures, NAVAID outages, etc.

(2) VFR Flight Not Recommended—When VFR flight is proposed and sky conditions or visibilities are present or forecast, surface or aloft, that in the briefer's judgement would make flight under visual flight rules doubtful, the briefer will describe the conditions, affected locations, and use the phrase "*VFR flight is not recommended.*" This recommendation is advisory in nature. The final decision as to whether the flight can be conducted safely rests solely with the pilot.

(3) Synopsis—A brief statement describing the type, location and movement of weather systems and/or air masses which might affect the proposed flight.

NOTE— These first 3 elements of a briefing may be combined in any order when the briefer believes it will help to more clearly describe conditions.

(4) Current Conditions—Reported weather conditions applicable to the flight will be summarized from all available sources; e.g., SAs, PIREPs, RAREPs. This element will be omitted if the proposed time of departure is beyond two hours, unless the information is specifically requested by the pilot.

(5) En Route Forecast—Forecast en route conditions for the proposed route are summarized in logical order; i.e., departure-climbout, en route, and descent.

(6) Destination Forecast—The destination forecast for the planned ETA. Any significant changes within 1 hour before and after the planned arrival are included.

(7) Winds Aloft—Forecast winds aloft will be summarized for the proposed route. The briefer will interpolate wind directions and speeds between levels and stations as necessary to provide expected conditions at planned altitudes.

(8) Notices to Airmen (NOTAMs)—

(a) Available NOTAM(D) information pertinent to the proposed flight.

(b) NOTAM(L) information pertinent to the departure and/or local area, if available, and pertinent FDC NOTAMs within approximately 400 miles of the FSS providing the briefing.

NOTE 1— NOTAM information may be combined with current conditions when the briefer believes it is logical to do so.

NOTE 2— NOTAM(D) information and FDC NOTAMs which have been published in the Notices to Airmen (Class II) Publication are not included in pilot briefings unless a review of this publication is specifically requested by the pilot. For complete flight information you are urged to review Class II NOTAMs and the Airport/Facility Directory in addition to obtaining a briefing.

(9) ATC Delays—Any known ATC delays and flow control advisories which might affect the proposed flight.

(10) Pilots may obtain the following from FSS briefers upon request:

(a) Information on military training routes and MOA activity within 100 NM of facility conducting briefing.

NOTE— For flights beyond 100 miles, pilots are encouraged to request updated information from en route FSSs.

(b) A review of the Notices to Airmen Publication (Class II NOTAMs) for pertinent NOTAMs and Special Notices.

(c) Approximate density altitude data.

(d) Information regarding such items as air traffic services and rules, customs/immigration procedures, ADIZ rules, search and rescue, etc.

(e) Other assistance as required.

c. ABBREVIATED BRIEFING— Request an Abbreviated Briefing when you need information to supplement mass disseminated data, update a previous briefing, or when you need only one or two specific items. Provide the briefer with appropriate background information, the time you received the previous information, and/or the specific items needed. You should indicate the source of the information already received so that the briefer can limit the briefing to the information that you have not received, and/or appreciable changes in meteorological conditions since your previous briefing. To the extent possible, the briefer will provide the information in the sequence shown for a Standard Briefing. If you request only one or two specific items, the briefer will advise you if adverse conditions are present or forecast. Details on these conditions will be provided at your request.

d. OUTLOOK BRIEFING— You should request an Outlook Briefing whenever your proposed time of departure is six or more hours from the time of the briefing. The briefer will provide available forecast data applicable to the proposed flight. This type of briefing is provided for planning purposes only. You should obtain a Standard or Abbreviated Briefing prior to departure in order to obtain such items as current conditions, updated forecasts, winds aloft and NOTAMs.

e. INFLIGHT BRIEFING— You are encouraged to obtain your preflight briefing by telephone or in person before departure. In those cases where you need to obtain a preflight briefing or an update to a previous briefing by radio, you should contact the nearest FSS to obtain this information. After communications have been established, advise the specialist of the type briefing you require and provide appropriate background information. You will be provided information as specified in the above paragraphs, depending on the type briefing requested. In addition, the specialist will recommend shifting to the flight watch frequency when conditions along the intended route indicate that it would be advantageous to do so.

f. Following any briefing, feel free to ask for any information that you or the briefer may have missed. It helps to save your questions until the briefing has been completed. This way, the briefer is able to present the information in a logical sequence, and lessens the chance of important items being overlooked.

503. EN ROUTE FLIGHT ADVISORY SERVICE (EFAS)

a. EFAS is a service specifically designed to provide en route aircraft with timely and meaningful weather advisories pertinent to the type of flight intended, route of flight and altitude. It is normally available throughout the conterminous U.S. from 6 a.m. to 10 p.m. at a service criterion of 5,000 feet above ground level. EFAS is provided by specially trained specialists from selected FSSs controlling one or more remote communications outlets covering a large geographical area. All communications are conducted on the designated EFAS frequency, 122.0 MHz.

b. Contact flight watch by using the name of the parent facility, followed by your aircraft identification and append the name of the nearest VOR to your position. The specialist needs to know this approximate location to select the most appropriate outlet for communications coverage.

EXAMPLE:

CLEVELAND FLIGHT WATCH, CESSNA ONE TWO THREE FOUR KILO, MANSFIELD VOR OVER.

c. Charts depicting the location of the flight watch control stations (parent facility) and the outlets they use are contained in the Airport Facility Directories (A/FD). If you do not know in which flight watch area you are flying, initiate contact by using the words "FLIGHT WATCH," your aircraft identification, and the name of the nearest VOR. The facility will respond using the name of the flight watch facility.

EXAMPLE:

FLIGHT WATCH, CESSNA ONE TWO THREE FOUR KILO, MANSFIELD VOR OVER.

d. En route Flight Advisory Service is provided by the following FSSs:

Albuquerque, NM
Birmingham, AL
Buffalo, NY
Charleston, WV
Cleveland, OH
Conroe, TX
Fort Worth, TX
Hawthorne, CA
Indianapolis, IN
Memphis, TN
Minneapolis, MN
Oakland, CA
Pittsburgh, PA
Prescott, AZ
Salt Lake City, UT
Seattle, WA
Walla Walla, WA
Atlanta, GA
Bridgeport, CT
Charleston, SC
Chicago, IL
Columbia, MO
Denver, CO
Grand Forks, ND
Huron, SD
Jackson, MS
Miami, FL
Montpelier, VT
Omaha, NE
Portland, OR
Raleigh, NC
San Juan, PR
Teterboro, NJ
Washington, DC

e. EFAS is not intended to be used for filing or closing flight plans, position reporting, to get a complete preflight briefing, or to obtain random weather reports and forecasts. In such instances, the flight watch specialist will provide the name and radio frequency of the FSS to contact for such services. Pilot participation is essential to the success of EFAS through a continuous exchange of information on winds, turbulence, visibility, icing, etc., between pilots in-flight and flight watch specialists on the ground. Pilots are encouraged to report good as well as bad and expected as well as unexpected flight conditions to flight watch facilities.

504. IN-FLIGHT WEATHER ADVISORIES

a. The NWS issues in-flight weather advisories designated as convective SIGMETs (WST), SIGMETs (WS), Center Weather Advisory (CWA), or AIRMETs (WA). These advisories are issued individually, however, the information contained in them is also included in relevant portions of the Area Forecast (FA). When these advisories are issued subsequent to the FA, they automatically amend appropriate portions of the FA until the FA itself has been amended. In-flight advisories serve to notify en route pilots of the possibility of encountering hazardous flying conditions which may not have been forecast at the time of the preflight briefing. Whether or not the condition described is potentially hazardous to a particular flight is for the pilot to evaluate on the basis of experience and the operational limits of the aircraft.

b. Convective SIGMETs are issued for the following phenomena:

(1) Tornadoes.

(2) Lines of thunderstorms.

(3) Embedded thunderstorms.

(4) Thunderstorm areas greater than or equal to thunderstorm intensity level 4 with an area coverage of 4/10 (40 percent) or more. (See RADAR WEATHER ECHO INTENSITY LEVELS in Pilot/Controller Glossary.)

(5) Hail greater than or equal to 3/4 inch diameter.

NOTE— Since thunderstorms are the reason for issuing the convective SIGMET, severe or greater turbulence, severe icing, and low-level wind shear (gust fronts, etc) are implied and will not be specified in the advisory.

c. CONVECTIVE SIGMET BULLETINS:

(1) Three Convective SIGMET bulletins, each covering a specified geographic area, are issued. These areas are the Eastern (E), Central (C), and Western (W) U.S. These bulletins are issued on a scheduled basis, hourly at 55 minutes past the hour (H+55), and as special bulletins on an unscheduled basis. The boundaries that separate the Eastern and Central, and the Central and Western U.S. are 87 and 107 degrees West, respectively. (See following figure for VORs and major locations used as reference points for the In-Flight Weather Advisory messages.)

(2) Each of the Convective SIGMET bulletins will be:

(a) Made up of one or more individually numbered Convective SIGMETs,

(b) Valid for 1 hour, and

(c) Removed from system automatically at 40 minutes past the hour (H+40).

d. SIGMETs within the conterminous U.S. are issued by the National Aviation Weather Advisory Unit (NAWAU) for the following hazardous weather phenomena:

(1) Severe and extreme turbulence.

(2) Severe icing.

(3) Widespread duststorms, sandstorms, or volcanic ash lowering visibilities to below three miles.

e. Center Weather Advisory: The CWA is an unscheduled in-flight, flow control, air traffic, and air crew advisory. By nature of its short lead time, the CWA is not a flight planning product. It is generally a Nowcast for conditions beginning within the next 2 hours. CWAs will be issued:

(1) As a supplement to an existing SIGMET, Convective SIGMET, AIRMET, or Area Forecast (FA).

(2) When an In-flight Advisory has not been issued but observed or expected weather conditions meet SIGMET/AIRMET criteria based on current pilot reports and reinforced by other sources of information about existing meteorological conditions.

(3) When observed or developing weather conditions do not meet SIGMET, Convective SIGMET, or AIRMET criteria, e.g., in terms of intensity or area coverage, but current pilot reports or other weather information sources indicate that an existing or anticipated meteorological phenomena will adversely affect the safe flow of air traffic within the air route traffic control center (ARTCC) area of responsibility.

f. AIRMETs within the conterminous U.S. are issued by the NAWAU for the following weather phenomena which are potentially hazardous to aircraft:

(1) Moderate icing.

(2) Moderate turbulence.

(3) Sustained winds of 30 knots or more at the surface.

(4) Widespread area of ceilings less than 1,000 feet and/or visibility less than three miles.

(5) Extensive mountain obscurement.

NOTE— If the above phenomena are adequately forecast in the FA, an AIRMET will not be issued.

g. SIGMETs and AIRMETs are identified by an alphanumeric designator which consists of an alphabetic identifier and issuance number. The first time an advisory is issued for a phenomenon associated with a particular weather system, it will be given the next alphabetic designator in the series, and will be numbered as the first for that designator, e.g., BRAVO 1. Subsequent advisories will retain the same alphabetic designator until the phenomenon ends. In the conterminous U.S., this means that a phenonmenon that is assigned an alphabetic designator in one area will retain that designator as it moves within the area or into one or more other areas. Issuances for the same phenomenon will be sequentially numbered, using the same alphabetic designator until the phenomena no longer exist. Alphabetic designators ALFA—NOVEMBER are used only for SIGMETs, while designators OSCAR—ZULU are used for AIRMETs.

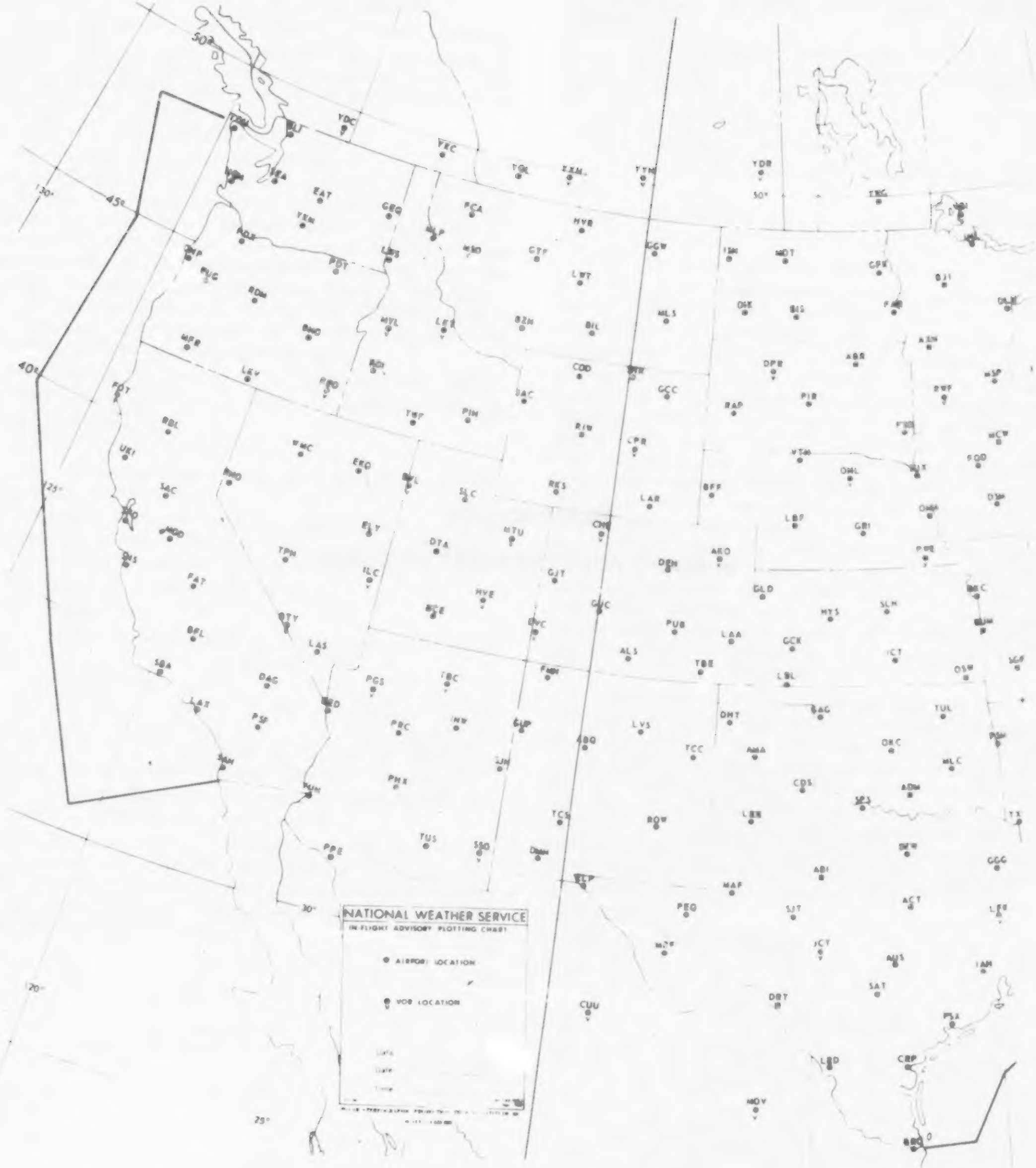
h. Each CWA will have a phenomenon number (1-6) immediately following the ARTCC identifier. This number will be assigned to each meteorologically distinct condition or conditions (e.g., jet stream clear air turbulence or low IFR and icing northwest of a low pressure center) meeting CWA issuance criteria. Following the product type (CWA) a two digit issuance number will be entered starting at midnight local each day. In addition those CWAs based on existing nonconvective SIGMETs/AIRMETs will include the associated alphanumeric designator (e.g. ALPHA 4).

EXAMPLE:

ZKC1 CWA01/ALPHA 4

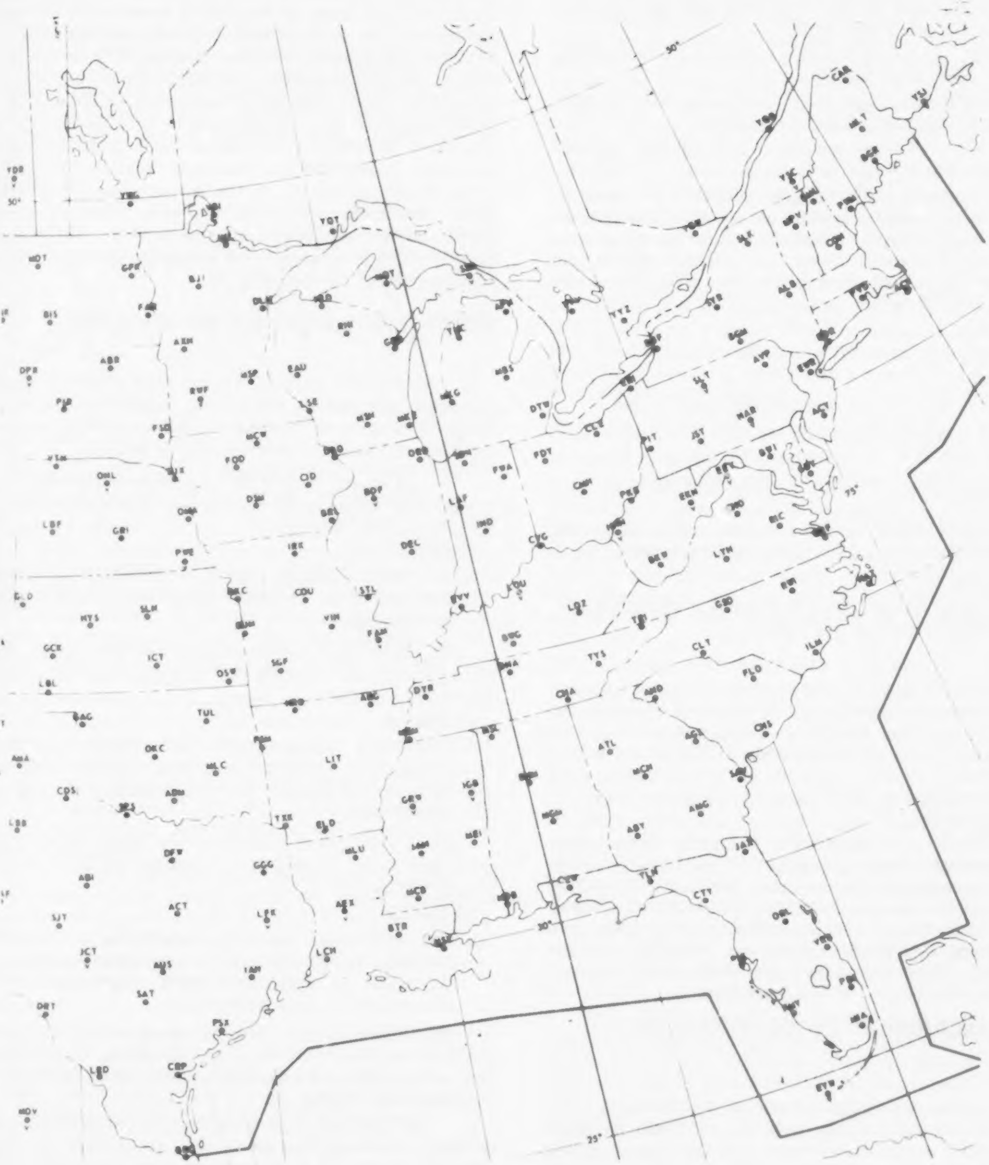
METEOROLOGY

IN-FLIGHT ADVISORY PLOTTING CHART



NATIONAL WEATHER SERVICE
IN-FLIGHT ADVISORY PLOTTING CHART
AIRPORT LOCATION
VOR LOCATION
Date
Time
50°
45°
40°
35°
30°
25°
130°
125°
120°
YDC
YXC
YQL
YXH
YYN
YDR
YWG
BLI
SEA
EAT
YKM
GEG
FCA
HVR
GGW
ISN
MOT
GFK
BJI
DLH
AST
PDX
PDT
LWS
MSO
GTF
LWT
MLS
DIK
BIS
FAR
ONP
EUG
RDM
BNO
MYL
LKT
BZN
BIL
ABR
AXN
MFR
LKV
BOI
COD
SHR
DPR
PIR
MSP
RWF
FOT
PIH
DAC
GCC
RAP
FSD
MCW
RBL
TWF
RIW
CPR
FOD
UKI
WMC
EKO
BVL
SLC
RKS
LAR
BFF
VTN
ONL
SUX
DSM
SAC
RNO
SFO
MOD
ELY
DTA
MTU
CYS
DEN
AKO
LBF
GRI
OMA
PWE
OSI
FAT
TPH
ILC
GJT
GLD
HYS
SLN
MKC
BTY
BCE
HVE
GUC
PUB
LAA
GCK
BFL
LAS
DVC
ALS
TBE
ICT
SBA
DAG
PGS
FMN
LBL
OSW
SGF
LAX
PSP
BLH
PRC
INW
GUP
ABQ
LVS
DHT
GAG
TUL
TCC
AMA
OKC
SAN
YUM
PHX
ZUN
FSM
CDS
ADM
MLC
SPS
TXK
TCS
ROW
LBB
PPE
TUS
SSO
DMN
DFW
GGG
ELP
ABI
MAF
PEQ
ACT
SJT
LFK
MRF
JCT
AUS
IAH
CUU
DRT
SAT
PSX
LRD
CRP
MOV
BRO

IN-FLIGHT ADVISORY PLOTTING CHART


50°
50°
30°
25°
75°
YQT
MOT
BIS
GFK
BJI
FAR
AXN
ABR
PIR
MSP
EAU
RWF
FSD
MCW
FOD
CID
DSM
ONL
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OMA
IRK
HYS
SLN
GCK
ICT
LBL
COU
STL
VIH
SGF
GAG
TUL
OKC
AMA
CDS
ABI
DFW
ACT
SJT
JCT
AUS
SAT
DRT
LRD
CRP
PSX
IAH
LCH
MLU
LIT
MKG
MBS
DTW
CLE
FDY
CMH
FWA
IND
BDF
DEL
CVG
EVV
LOZ
TYS
CLT
ATL
MGM
ABY
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ACY
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EYW

505. CATEGORICAL OUTLOOKS

a. Categorical outlook terms, describing general ceiling and visibility conditions for advanced planning purposes, are defined as follows:

(1) **LIFR (Low IFR)** — Ceiling less than 500 feet and/or visibility less than 1 mile.

(2) **IFR** — Ceiling 500 to less than 1,000 feet and/or visibility 1 to less than 3 miles.

(3) **MVFR (Marginal VFR)** — Ceiling 1,000 to 3,000 feet and/or visibility 3 to 5 miles inclusive.

(4) **VFR** — Ceiling greater than 3,000 feet and visibility greater than 5 miles; includes sky clear.

b. The cause of LIFR, IFR, or MVFR is indicated by either ceiling or visibility restrictions or both. The contraction "CIG" and/or weather and obstruction to vision symbols are used. If winds or gusts of 25 knots or greater are forecast for the outlook period, the word "WIND" is also included for all categories, including VFR.

EXAMPLE:

LIFR CIG — Low IFR due to low ceiling.

EXAMPLE:

IFR F — IFR due to visibility restricted by fog.

EXAMPLE:

MVFR CIG H K — Marginal VFR due both to ceiling and to visibility restricted by haze and smoke.

EXAMPLE:

IFR CIG R WIND — IFR due both to low ceiling and to visibility restricted by rain; wind expected to be 25 knots or greater.

506. PILOTS AUTOMATIC TELEPHONE WEATHER ANSWERING SERVICE (PATWAS)

a. PATWAS is a continuous recording of meteorological and aeronautical information which is available at selected locations by telephone. Normally the recording contains a summary of data for an area within 50NM of the parent station; however, at some locations route information similar to that available on the Transcribed Weather Broadcast (TWEB) is included.

b. PATWAS is not intended to substitute for specialist provided preflight briefings except for local flights. It is, however, recommended for use as a preliminary briefing, and often will be valuable in helping you to make a "go or no go" decision. Pilots are encouraged to avail themselves of this service. PATWAS locations are found in the Airport/Facility Directory under the FSS and National Weather Service Telephone Numbers section.

507. TRANSCRIBED WEATHER BROADCAST (TWEB)

a. Equipment is provided at selected FSSs by which meteorological and aeronautical data are recorded on tapes and broadcast continuously over selected low-frequency (190-535 kHz) navigational aids (L/MF range or H facility) and/or VORs. Broadcasts are made from a series of individual tape recordings, and changes, as they occur, are transcribed onto the tapes. The information provided varies depending on the type equipment available. Generally the broadcast contains route oriented data with specially prepared NWS forecasts, In-flight Advisories and winds aloft, plus preselected current information such as weather reports, NOTAMs and special notices. In some locations, the information is broadcast over the local VOR only and is limited to such items as the hourly weather for the parent station and up to 5 immediately adjacent stations, local NOTAM information, terminal forecast (FT) for the parent station, adverse conditions extracted from In-flight Advisories and other potentially hazardous conditions. At selected locations telephone access to the TWEB has been provided (TEL-TWEB). Telephone numbers for this service are found in the FSS and National Weather Service Telephone Numbers section of the Airport/Facility Directory. These broadcasts are made available primarily for preflight and in-flight planning, and as such, should not be considered as a substitute for specialist provided preflight briefings except for local flights.

508. IN-FLIGHT WEATHER BROADCASTS

a. WEATHER ADVISORY BROADCASTS - FAA FSSs broadcast Convective SIGMETs, SIGMETs, CWAs, and AIRMETs during their valid period when they pertain to the area within 150 NM of the FSS as follows:

(1) Convective SIGMET - Upon receipt and at 15-minute intervals H+00, H+15, H+30, and H+45 for the first hour after issuance.

EXAMPLE:

AVIATION BROADCAST, WEATHER ADVISORY, CONVECTIVE SIGMET (IDENTIFICATION) (TEXT OF ADVISORY).

(2) SIGMETs, CWAs, and AIRMETs - Upon receipt and at 30-minute intervals at H+15 and H+45 for the first hour after issuance.

EXAMPLE:

AVIATION BROADCAST, WEATHER ADVISORY, (AREA OR ARTCC IDENTIFICATION) SIGMET, CWA, OR AIRMET (IDENTIFICATION) (TEXT OF ADVISORY).

(3) Thereafter, a summarized alert notice will be broadcast at H+15 and H+45 during the valid period of the advisories.

EXAMPLE:

AVIATION BROADCAST, WEATHER ADVISORY, A (CONVECTIVE SIGMET) (SIGMET) (CWA) OR (AIRMET) IS CURRENT FOR (DESCRIPTION OF WEATHER) (AREA AFFECTED).

(4) Pilots, upon hearing the alert notice, if they have not received the advisory or are in doubt, should contact the nearest FSS and ascertain whether the advisory is pertinent to their flights.

b. ARTCCs broadcast a Convective SIGMET, SIGMET, or CWA alert once on all frequencies, except emergency, when any part of the area described is within 150 miles of the airspace under their jurisdication. These broadcasts contain SIGMET or CWA (Identification) and a brief description of the weather activity and general area affected.

EXAMPLE:

> ATTENTION ALL AIRCRAFT, SIGMET DELTA THREE, FROM MYTON TO TUBA CITY TO MILFORD, SEVERE TURBULENCE, AND SEVERE CLEAR ICING BELOW ONE ZERO THOUSAND FEET. EXPECTED TO CONTINUE BEYOND ZERO THREE ZERO ZERO ZULU.

EXAMPLE:

> ATTENTION ALL AIRCRAFT, CONVECTIVE SIGMET TWO SEVEN EASTERN. FROM THE VICINITY OF ELMIRA TO PHILLIPSBURG. SCATTERED EMBEDDED THUNDERSTORMS MOVING EAST AT ONE ZERO KNOTS. A FEW INTENSE LEVEL FIVE CELLS, MAXIMUM TOPS FOUR FIVE ZERO.

EXAMPLE:

> ATTENTION ALL AIRCRAFT, KANSAS CITY CENTER WEATHER ADVISORY ONE ZERO THREE. NUMEROUS REPORTS OF MODERATE TO SEVERE ICING FROM EIGHT TO NINER THOUSAND FEET IN A THREE ZERO MILE RADIUR OF ST. LOUIS. LIGHT OR NEGATIVE ICING REPORTED FROM FOUR THOUSAND TO ONE TWO THOUSAND FEET REMAINDER OF KANSAS CITY CENTER AREA.

NOTE.— Terminal control facilities have the option to limit the convective SIGMET, SIGMET, or CWA broadcast as follows: local control and approach control positions may opt to broadcast SIGMET or CWA alerts only when any part of the area described is within 50 miles of the airspace under their jurisdiction.

c. HAZARDOUS IN-FLIGHT WEATHER ADVISORY SERVICE (HIWAS) - This is a continuous broadcast of inflight weather advisories including summarized SIGMETs, convective SIGMETs, CWAs, AIRMETs and urgent PIREPs. HIWAS has been adopted as a national program and will be implemented throughout the conterminous U.S. as resources permit. In those areas where HIWAS is commissioned, ARTCC, Terminal ATC and FSS facilities have discontinued the broadcast of in-flight advisories as described in the preceding paragraph. HIWAS is an additional source of hazardous weather information which makes these data available on a continuous basis. It is not, however, a replacement for preflight or in-flight briefings or realtime weather updates from Flight Watch (EFAS). As HIWAS is implemented in individual center areas, the commissioning will be advertised in the Notices to Airmen (Class II) Publication.

(1) Where HIWAS Has Been Implemented - A HIWAS alert will be broadcast on all except emergency frequencies once upon receipt by ARTCC and terminal facilities which will include an alert announcement, frequency instruction, number, and type of advisory updated, e.g., SIGMET, Convective SIGMET, or CWA.

EXAMPLE:

> ATTENTION ALL AIRCRAFT, MONITOR HIWAS OR CONTACT A FLIGHT SERVICE STATION ON FREQUENCY ONE TWO TWO POINT ZERO OR ONE TWO TWO POINT TWO FOR NEW CONVECTIVE SIGMET (IDENTIFICATION) INFORMATION.

(2) In HIWAS ARTCC Areas - FSSs will broadcast a HIWAS update announcement once on all except emergency frequencies upon completion of recording an update to the HIWAS broadcast. Included in the broadcast will be the type of advisory updated, e.g., SIGMET, convective SIGMET, CWA, ect.

EXAMPLE:

> ATTENTION ALL AIRCRAFT, MONITOR HIWAS OR CONTACT FLIGHT WATCH OR FLIGHT SERVICE FOR NEW CONVECTIVE SIGMET INFORMATION.

d. UNSCHEDULED BROADCASTS - These broadcasts are made by FSSs on VOR and selected VHF frequencies upon receipt of special weather reports, PIREPs, NOTAMs and other information considered necessary to enhance safety and efficiency of flight. These broadcasts will be made at random times and will begin with the announcement "Aviation Broadcast" followed by identification of the data.

EXAMPLE:

> AVIATION BROADCAST, SPECIAL WEATHER REPORT, (Notice to Airmen, Pilot Report, etc.) (location name twice) THREE SEVEN (past the hour) OBSERVATION...etc.

e. ALASKAN SCHEDULED BROADCASTS - Selected FSSs in Alaska having voice capability on radio ranges (VOR) or radio beacons (NDB) broadcast weather reports and Notice to Airmen information at 15 minutes past each hour from reporting points within approximately 150 miles from the broadcast station.

509. WEATHER OBSERVING PROGRAMS

a. Manual Observations - Surface weather observations are taken at more than 600 locations in the United States. With only a few exceptions, these stations are located at airport sites and most are manned by FAA or NWS personnel who manually observe, perform calculations, and enter the observation into the distribution system. The format and coding of these observations are contained in paragraph 527.

b. Automated Weather Observing System (AWOS)

(1) Automated weather reporting systems are now being installed at several airports. These systems consist of various sensors, a processor, a voice synthesizer, and transmitter to relay local real-time weather data directly to the pilot.

(2) Generically referred to as AWOS (Automated Weather Observing System), these real-time systems are operationally classified into three basic levels: AWOS-1, AWOS-2, and AWOS-3. AWOS-1 reports altimeter setting and wind data, and usually temperature, dewpoint, and density altitude. AWOS-2, when approved for operational use, will provide the information provided by AWOS-1, plus visibility. AWOS-3, when approved for operational use, will provide the information provided by AWOS-1, plus visibility and cloud/ceiling data.

(3) The information is transmitted over a radio frequency or the voice portion of a local NAVAID. AWOS transmissions are receivable within 25 NM of the AWOS site, at or above 3000 feet AGL. In many cases, AWOS signals are receivable on the surface of the airport. Most devices automatically transmit a 20 to 30 second weather message once each minute. Pilots should monitor the designated frequency for the automated weather message. There is no two-way communication capability. Most AWOS weather data can be accessed via telephone.

(4) Selected individual systems may be incorporated into nationwide data collection and dissemination networks in the future. AWOS information (system level, frequency, phone number, etc.) concerning specific locations, will be published as they become operational, in the Airport/Facility Directory, and where applicable, on published Instrument Approach Procedures.

c. **Automatic Meteorological Observing Stations (AMOS)**

(1) Full parameter AMOS facilities probide data for the basic weather program at remote, unstaffed, or part-time staffed locations at approximately ninety locations in the United States. They report temperature, dew point, wind, pressure, and precipitation (liquid) amount. At staffed AMOS locations, an observer may manually add visually observed and manually calculated elements to the automatic reports. The elements manually added are sky condition, visibility, weather, obstructions to vision, and sea level pressure. The content and format of AMOS reports is the same as the manually observed reports, except the acronym "AMOS" or "RAMOS" (for Remote Automatic Meteorological Observing Station) will be the first item of the report.

(2) Partial parameter AMOS stations only report some of the elements contained in the full parameter locations, normally wind. These observations are not normally disseminated through aviation weather circuits.

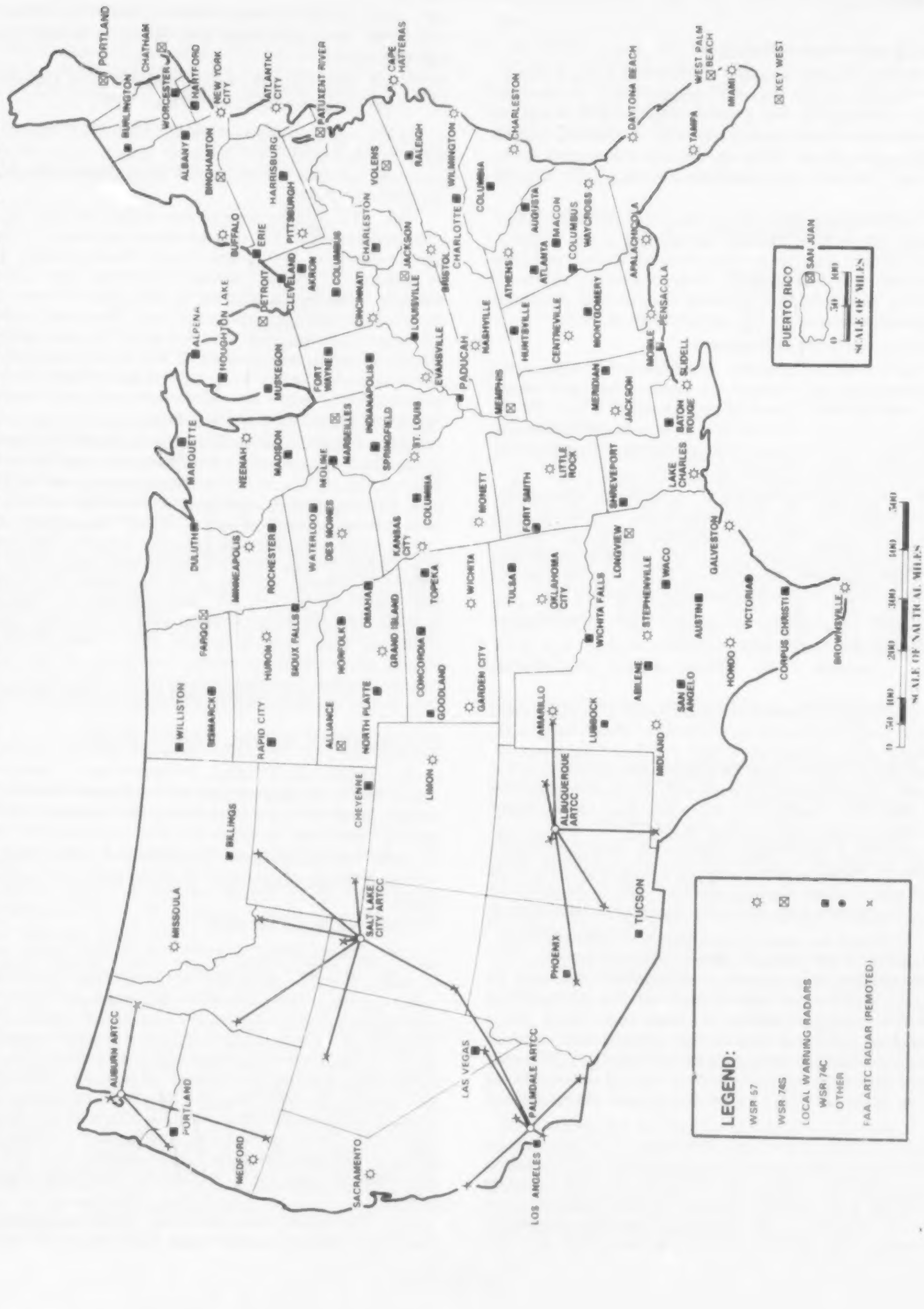
d. Automatic Observing Stations (AUTOB) - There are four AUTOBs in operation located at Winslow, Arizona (INW); Sandberg, California (SDB); Del Rio, Texas (DRT); and Wendover, Utah (ENV). These stations report all normal surface aviation weather elements, but cloud height and visibility are reported in a manner different from the conventional weather report. See paragraph 528 for a description of these reports.

510. WEATHER RADAR SERVICES

a. The National Weather Service operates a network of 56 weather radars. These radars are spaced in such a manner as to enable them to detect and identify the type and characteristics of most of the precipitation east of the Continental Divide. In addition, 2 radars of the DOD and 22 FAA radars augment the network in the conterminous U.S. (See map.)

b. A scheduled radar observation is transmitted at 35 minutes past each hour, and more often under certain conditions. These weather radar reports are transmitted on service A to NWS and FAA stations and are available for use in preflight and in-flight planning. An hourly plain language radar summary is prepared at NWS radar offices and transmitted over the NOAA Weather Wire Circuit. In addition, hourly radar summary charts are prepared at the National Meteorological Center at Suitland, Maryland, for transmission on national facsimile circuits.

c. Some FSSs located near radar equipped national facilities have weather radar repeater scopes. The FSS specialist at these locations are certified to make interpretations of the weather displayed on the radar scope. They can brief a pilot on the displayed weather pattern as to the area covered and the weather movement. However, technical analysis of the characteristics of precipitation and cells is made by the NWS, who in turn forwards this information to the FSS pilot briefer. The weather radar presents a very dependable display of the weather within 125 miles, and storms of considerable heights and intensities can be seen at ranges of more than 125 NM. Through the combined efforts of the NWS and the FSS, a pilot can receive a comprehensive picture of the weather to assist him in planning a safe flight.


LEGEND:
WSR 57
WSR 74S
LOCAL WARNING RADARS
WSR 74C
OTHER
FAA ARTC RADAR (REMOTED)
PUERTO RICO
SAN JUAN
SCALE OF MILES
SCALE OF NAUTICAL MILES
PORTLAND
CHATHAM
BURLINGTON
WORCESTER
HARTFORD
NEW YORK CITY
ALBANY
BINGHAMTON
ATLANTIC CITY
PATUXENT RIVER
CAPE HATTERAS
HARRISBURG
PITTSBURGH
BUFFALO
ERIE
VOLENS
RALEIGH
WILMINGTON
CHARLESTON
COLUMBIA
DAYTONA BEACH
WEST PALM BEACH
MIAMI
KEY WEST
TAMPA
WAYCROSS
COLUMBUS
MACON
AUGUSTA
ATHENS
ATLANTA
CHARLOTTE
BRISTOL
JACKSON
CHARLESTON
COLUMBUS
AKRON
CLEVELAND
DETROIT
HOUGHTON LAKE
ALPENA
CINCINNATI
LOUISVILLE
NASHVILLE
HUNTSVILLE
CENTREVILLE
MONTGOMERY
APALACHICOLA
PENSACOLA
MOBILE
SLIDELL
BATON ROUGE
JACKSON
MERIDIAN
MEMPHIS
PADUCAH
EVANSVILLE
INDIANAPOLIS
FORT WAYNE
MUSKEGON
MARQUETTE
NEENAH
MADISON
MOLINE
MARSEILLES
SPRINGFIELD
ST. LOUIS
COLUMBIA
MONETT
LITTLE ROCK
FORT SMITH
SHREVEPORT
LAKE CHARLES
GALVESTON
LONGVIEW
WACO
STEPHENVILLE
AUSTIN
VICTORIA
CORPUS CHRISTI
BROWNSVILLE
HONDO
SAN ANGELO
ABILENE
MIDLAND
LUBBOCK
WICHITA FALLS
OKLAHOMA CITY
TULSA
WICHITA
TOPEKA
KANSAS CITY
DES MOINES
WATERLOO
ROCHESTER
MINNEAPOLIS
DULUTH
FARGO
SIOUX FALLS
HURON
NORFOLK
OMAHA
GRAND ISLAND
CONCORDIA
GOODLAND
GARDEN CITY
AMARILLO
ALBUQUERQUE ARTCC
LIMON
NORTH PLATTE
ALLIANCE
RAPID CITY
BISMARCK
WILLISTON
CHEYENNE
BILLINGS
MISSOULA
SALT LAKE CITY ARTCC
TUCSON
PHOENIX
LAS VEGAS
PALMDALE ARTCC
LOS ANGELES
SACRAMENTO
MEDFORD
PORTLAND
AUBURN ARTCC
0 50 100 200 300 400 500

NOAA NATIONAL WEATHER SERVICE RADAR NETWORK

511. ATC IN-FLIGHT WEATHER AVOIDANCE ASSISTANCE

a. ATC Radar Weather Display

(1) Areas of radar weather clutter result from rain or moisture. Radars cannot detect turbulence. The determination of the intensity of the weather displayed is based on its precipitation density. Generally, the turbulence associated with a very heavy rate of rainfall will normally be more severe than any associated with a very light rainfall rate.

(2) ARTCCs are phasing in computer generated digitized radar displays to replace broadband radar display. This new system, known as Narrowband Radar, provides the controller with two distinct levels of weather intensity by assigning radar display symbols for specific precipitation densities measured by the narrowband system.

b. Weather Avoidance Assistance

(1) To the extent possible, controllers will issue pertinent information on weather or chaff areas and assist pilots in avoiding such areas when requested. Pilots should respond to a weather advisory by either acknowledging the advisory or by acknowledging the advisory and requesting an alternative course of action as follows:

(a) Request to deviate off course by stating the number of miles and the direction of the requested deviation. In this case, when the requested deviation is approved, the pilot is expected to provide his own navigation, maintain the altitude assigned by ATC and to remain within the specified mileage of his original course.

(b) Request a new route to avoid the affected area.

(c) Request a change of altitude.

(d) Request radar vectors around the affected areas.

(2) For obvious reasons of safety, an IFR pilot must not deviate from the course or altitude or flight level without a proper ATC clearance. When weather conditions encountered are so severe that an immediate deviation is determined to be necessary and time will not permit approval by ATC, the pilot's emergency authority may be exercised.

(3) When the pilot requests clearance for a route deviation or for an ATC radar vector, the controller must evaluate the air traffic picture in the affected area, and coordinate with other controllers (if ATC jurisdictional boundaries may be crossed) before replying to the request.

(4) It should be remembered that the controller's primary function is to provide safe separation between aircraft. Any additional service, such as weather avoidance assistance, can only be provided to the extent that it does not derogate the primary function. It's also worth noting that the separation workload is generally greater than normal when weather disrupts the usual flow of traffic. ATC radar limitations and frequency congestion may also be a factor in limiting the controller's capability to provide additional service.

(5) It is very important, therefore, that the request for deviation or radar vector be forwarded to ATC as far in advance as possible. Delay in submitting it may delay or even preclude ATC approval or require that additional restrictions be placed on the clearance. Insofar as possible the following information should be furnished to ATC when requesting clearance to detour around weather activity:

(a) Proposed point where detour will commence.

(b) Proposed route and extent of detour (direction and distance).

(c) Point where original route will be resumed.

(d) Flight conditions (IFR or VFR).

(e) Any further deviation that may become necessary as the flight progresses.

(f) Advise if the aircraft is equipped with functioning airborne radar.

(6) To a large degree, the assistance that might be rendered by ATC will depend upon the weather information available to controllers. Due to the extremely transitory nature of severe weather situations, the controller's weather information may be of only limited value if based on weather observed on radar only. Frequent updates by pilots giving specific information as to the area affected, altitudes intensity and nature of the severe weather can be of considerable value. Such reports are relayed by radio or phone to other pilots and controllers and also receive widespread teletypewriter dissemination.

(7) Obtaining IFR clearance or an ATC radar vector to circumnavigate severe weather can often be accommodated more readily in the en route areas away from terminals because there is usually less congestion and, therefore, offer greater freedom of action. In terminal areas, the problem is more acute because of traffic density, ATC coordination requirements, complex departure and arrival routes, adjacent airports, etc. As a consequence, controllers are less likely to be able to accommodate all requests for weather detours in a terminal area or be in a position to volunteer such routing to the pilot. Nevertheless, pilots should not hesitate to advise controllers of any observed severe weather and should specifically advise controllers if they desire circumnavigation of observed weather.

512. RUNWAY VISUAL RANGE (RVR)

a. RVR visibility values are measured by transmissometers mounted on towers along the runway. A full RVR system consists of:

(1) Transmissometer projector and related items.

(2) Transmissometer receiver (detector) and related items.

(3) Analogue recorder.

(4) Signal data converter and related items.

(5) Remote digital or remote display programmer.

b. The transmissometer projector and receiver are mounted on towers either 250 or 500 feet apart. A known intensity of light is emitted from the projector and is measured by the receiver. Any obscuring matter such as rain, snow, dust, fog, haze or smoke reduces the light intensity arriving at the receiver. The resultant intensity measurement is then converted to an RVR value by the signal data converter. These values are displayed by readout equipment in the associated air traffic facility and updated approximately once every minute for controller issuance to pilots.

c. The signal data converter receives information on the high intensity runway edge light setting in use (step 3,

4, or 5); transmission values from the transmissometer, and the sensing of day or night conditions. From the three data sources, the system will compute appropriate RVR values. Due to variable conditions, the reported RVR values may deviate somewhat from the true observed visual range due to the slant range consideration, brief time delays between the observed RVR conditions and the time they are transmitted to the pilot, and rapidly changing visibility conditions.

d. An RVR transmissometer established on a 500 foot baseline provides digital readouts to a minimum of 1,000 feet. A system established on a 250 foot baseline provides digital readouts to a minimum of 600 feet, which are displayed in 200 foot increments to 3000 feet and in 500 foot increments from 3,000 feet to a maximum value of 6,000 feet.

e. RVR values for Category IIIa operations extend down to 700 feet RVR; however, only 600 and 800 feet are reportable RVR increments. The 800 RVR reportable value covers a range of 701 feet to 900 feet and is therefore a valid minimum indication of Category IIIa operations.

f. Approach categories with the corresponding minimum RVR values are as follows:

Category	*Visibility (RVR)*
Nonprecision	2400 feet
Category I	1800 feet
Category II	1200 feet
Category IIIa	700 feet
Category IIIb	150 feet
Category IIIc	0 feet

g. Ten minute maximum and minimum RVR values for the designated RVR runway are reported in the remarks section of the aviation weather report when the prevailing visibility is less than one mile and/or the RVR is 6,000 feet or less. ATCTs report RVR when the prevailing visibility is 1 mile or less and/or the RVR is 6,000 feet or less.

h. Details on the requirements for the operational use of RVR are contained in FAA ADVISORY CIRCULAR—97-1, "RUNWAY VISUAL RANGE." Pilots are responsible for compliance with minimums prescribed for their class of operations in appropriate FARs and/or operations specifications.

513. REPORTING OF CLOUD HEIGHTS

a. Ceiling, by definition in FARs, and as used in Aviation Weather Reports and Forecasts, is the height *above ground (or water) level* of the lowest layer of clouds or obscuring phenomenon that is reported as "broken", "overcast", or "obscuration" and not classified as "thin" or "partial". For example, a forecast which reads "CIGS WILL BE GENLY 1 TO 2 THSD FEET" refers to heights *above ground level* (AGL). A forecast which reads "BRKN TO OVC LYRS AT 8 TO 12 THSD MSL" states that the height is *above mean sea level* (MSL).

b. Pilots usually report height values above MSL, since they determine heights by the altimeter. This is taken in account when disseminating and otherwise applying information received from pilots. ("Ceilings" heights are always above ground level.) In reports disseminated as PIREPs, height references are given the same as received from pilots, that is, above MSL. In the following example of an hourly observation, a pilot report of the heights of the bases and tops of an overcast layer in the terminal area is converted by the reporting station to reflect AGL to report the base of the overcast layer (E12). The pilot's reported top of the overcast layer (23) is not converted to AGL and is shown in the remarks section (last item) of the weather reporting (top ovc 23)

EXAMPLE:

E12 OVC 2FK 132/49//47/0000/002/TOP OVC 23

c. In aviation forecasts (Terminal, Area, or In-flight Advisories) ceilings are denoted by the prefix "C" when used with sky cover symbols as in "LWRG to C5 OVC-1TRW", or by the contraction "CIG" before, or the contraction "AGL" after, the forecast cloud height value. When the cloud base is given in height above MSL, it is so indicated by the contraction "MSL" or "ASL" following the height value. The heights of clouds tops, freezing level, icing and turbulence are always given in heights above ASL or MSL.

514. REPORTING PREVAILING VISIBILITY

a. Surface (horizontal) visibility is reported in weather observations in terms of statute miles and increments thereof (e.g., 1/16, 1/8, 1/4, 1/2, 3/4, 1, 1 1/4, etc.). Visibility is determined through the ability to see and identify preselected and prominent objects at a known distance from the usual point of observation. Visibilities which are determined to be less than 7 miles identify the obscuring atmospheric condition, (e.g., fog, haze, smoke, etc., or combinations thereof).

b. Prevailing visibility is the greatest visibility equalled or exceeded throughout at least half of the horizon circle, which need not be continuous. Segments of the horizon circle which may have a significantly lower visibility may be reported in the remarks section of the weather report (i.e., the southeastern quadrant of the horizon circle may be determined to be 2 miles in fog while the remaining quadrants are determined to be 3 miles in fog).

c. When the prevailing visibility at the usual point of observation, or at the tower level, is less than 4 miles, certificated tower personnel will take visibility observations in addition to those taken at the usual point of observation. The lower of these two values will be used as the prevailing visibility for aircraft operations.

515. ESTIMATING INTENSITY OF PRECIPITATION

a. LIGHT — Scattered drops or flakes that do not completely wet or cover an exposed surface, regardless of duration, to 0.10 inch per hour; maximum 0.01 inch in 6 minutes.

b. MODERATE — .11 inch to 0.30 inch per hour; more than 0.01 inch to 0.03 inch in 6 minutes.

c. HEAVY — More than 0.30 inch per hour; more than 0.03 inch in 6 minutes.

516. ESTIMATING INTENSITY OF DRIZZLE

a. LIGHT — Scattered drops that do not completely wet surface, regardless of duration, to 0.01 inch per hour.

b. MODERATE — More than 0.01 inch to 0.02 inch per hour.

c. HEAVY — More than 0.02 inch per hour.

517. ESTIMATING INTENSITY OF SNOW

a. LIGHT — Visibility 5/8 statute mile or more.

b. MODERATE — Visibility less than 5/8 statute mile but not less than 5/16 statute mile.

c. HEAVY — Visibility less than 5/16 statute mile.

518—519. RESERVED

520. PILOT WEATHER REPORTS (PIREP)

a. FAA air traffic facilities are required to solicit PIREPs when the following conditions are reported or forecast: Ceilings at or below 5,000 feet; Visibility at or below 5 miles; Thunderstorms and related phenomena; Icing of light degree or greater; Turbulence of moderate degree or greater; and Windshear.

b. Pilots are urged to cooperate and promptly volunteer reports of these conditions and other atmospheric data such as: Cloud bases, tops and layers; Flight visibility; Precipitation; Visibility restrictions such as haze, smoke and dust; Wind at altitude; and Temperature aloft.

c. PIREPs should be given to the ground facility with which communications are established, i.e., EFAS, FSS, ARTCC or terminal ATC. One of the primary duties of EFAS facilities, radio call "FLIGHT WATCH", is to serve as a collection point for the exchange of PIREPs with en route aircraft.

d. If pilots are not able to make PIREPs by radio, reporting upon landing of the in-flight conditions encountered to the nearest FSS or Weather Service Office will be helpful. Some of the uses made of the reports are:

(1) The ATCT uses the reports to expedite the flow of air traffic in the vicinity of the field and for hazardous weather avoidance procedures.

(2) The FSS uses the reports to brief other pilots, to provide in-flight advisories, and weather avoidance information to en route aircraft.

(3) The ARTCC uses the reports to expedite the flow of en route traffic, to determine most favorable altitudes, and to issue hazardous weather information within the center's area.

(4) The NWS uses the reports to verify or amend conditions contained in aviation forecast and advisories. In some cases, pilot reports of hazardous conditions are the triggering mechanism for the issuance of advisories. They also use the reports for pilot weather briefings.

(5) The NWS, other government organizations, the military, and private industry groups use PIREPs for research activities in the study of meteorological phenomena.

(6) All air traffic facilities and the NWS forward the reports received from pilots into the weather distribution system to assure the information is made available to all pilots and other interested parties.

e. The FAA, NWS, and other organizations that enter PIREPs into the weather reporting system use the format listed below. Items 1 through 6 are included in all transmitted PIREPs along with one or more of items 7 through 13. Although the PIREP should be as complete and concise as possible, pilots should not be overly concerned with strict format or phraseology. The important thing is that the information is relayed so other pilots may benefit from your observation. If a portion of the report needs clarification, the ground station will request the information.

	PIREP ELEMENTS	PIREP CODE	CONTENTS
1.	3-letter station identifier	XXX	Nearest weather reporting location to the reported phenomena
2.	Report type	UA or UUA	Routine or Urgent PIREP
3.	Location	/OV	In relation to a VOR
4.	Time	/TM	Coordinated Universal Time
5.	Altitude	/FL	Essential for turbulence and icing reports
6.	Type Aircraft	/TP	Essential for turbulence and icing reports
7.	Sky cover	/SK	Cloud height and coverage (scattered, broken, or overcast)
8.	Weather	/WX	Flight visibility, precipitation, restrictions to visibility, etc.
9.	Temperature	/TA	Degrees Celsius

—Continued

	PIREP ELEMENTS	PIREP CODE	CONTENTS
10.	Wind	/WV	Direction in degrees magnetic and speed in knots
11.	Turbulence	/TB	See paragraph 522
12.	Icing	/IC	See paragraph 521
13.	Remarks	/RM	For reporting elements not included or to clarify previously reported items

Completed PIREPs will be transmitted to weather circuits as in the following examples:

CMH UA /OV APE 230010/TM 1516/FL085/TP BE80/SK BKN 065/WX FV03 H K/TA 20/TB LGT

Translation: One zero miles southwest of Appleton VOR; Time 1516 UTC; Altitude eight thousand five hundred; Aircraft type BE80; Top of the broken cloud layer is six thousand five hundred; Flight visibility 3 miles with haze and smoke; Air Temperature 20 degrees Celsius; Light turbulence.

CRW UV /OV BKW 360015-CRW/TM 1815/FL120//TP BE99/SK OVC/WX R/TA -08 /WV 290030/TB LGT-MDT/IC LGT RIME/RM MDT MXD ICG DURGC ROA NWBND FL080-100 1750

Translation: From 15 miles north of Beckley VOR to Charleston VOR; Time 1815 UTC; Altitude 12,000 feet; Type aircraft, BE-99; In clouds; Rain; Temperature -08 Celsius; Wind 290 degrees magnetic at 30 knots; Light to moderate turbulence; Light Rime Icing; Encountered moderate mixed icing during climb northwestbound from Roanoke Va between 8000 and 10,000 feet at 1750 UTC.

521. PIREPS RELATING TO AIRFRAME ICING

a. The effects of ice on aircraft are cumulative — Thrust is reduced, Drag increases, Lift lessens, Weight increases. The results are an increase in stall speed and a deterioration of aircraft performance. In extreme cases, 2 to 3 inches of ice can form on the leading edge of the airfoil in less than 5 minutes. It takes but 1/2 inch of ice to reduce the lifting power of some aircraft by 50 percent and increases the frictional drag by an equal percentage.

b. A pilot can expect icing when flying in visible precipitation such as rain or cloud droplets, and the temperature is 0 degrees Celsius or colder. When icing is detected, a pilot should do one of two things (particularly if the aircraft is not equipped with deicing equipment), he should get out of the area of precipitation or go to an altitude where the temperature is above freezing. This "warmer" altitude may not always be a lower altitude. Proper preflight action includes obtaining information on the freezing level and the above-freezing levels in precipitation areas. Report icing to ATC/FSS, and if operating IFR, request new routing or altitude if icing will be a hazard. Be sure to give type of aircraft to ATC when reporting icing. The following describes how to report icing conditions.

(1) Trace — Ice becomes perceptible. Rate of accumulation is slightly greater than the rate of sublimation. It is not hazardous even though deicing/anti-icing equipment is not utilized, unless encountered for an extended period of time (over 1 hour).

(2) Light — The rate of accumulation may create a problem if flight is prolonged in this environment (over 1 hour). Occasional use of deicing/anti-icing equipment removes/prevents accumulation. It does not present a problem if the deicing/anti-icing equipment is used.

(3) Moderate — The rate of accumulation is such that even short encounters become potentially hazardous and use of deicing/anti-icing equipment or flight diversion is necessary.

(4) Severe — The rate of accumulation is such that deicing/anti-icing equipment fails to reduce or control the hazard. Immediate flight diversion is necessary.

EXAMPLE:

Pilot Report: Give Aircraft Identification, Location, Time (UTC), Intensity of Type, Altitude/FL, Aircraft Type, IAS, and Outside Air Temperature.

NOTE 1.—Rime Ice: Rough, milky, opaque ice formed by the instantaneous freezing of small supercooled water droplets.

NOTE 2.—Clear Ice: A glossy, clear, or translucent ice formed by the relatively slow freezing of large supercooled water droplets.

NOTE 3.—The Outside Air Temperature should be requested by the FSS/ATC if not included in the PIREP.

522. PIREPS RELATING TO TURBULENCE

a. When encountering turbulence, pilots are urgently requested to report such conditions to ATC as soon as practicable. PIREPs relating to turbulence should state:

(1) Aircraft location.

(2) Time of occurrence in UTC.

(3) Turbulence intensity.

(4) Whether the turbulence occurred in or near clouds.

(5) Aircraft altitude, or Flight Level.

(6) Type of Aircraft.

(7) Duration of turbulence.

EXAMPLE:

OVER OMAHA, 1232Z, MODERATE TURBULENCE IN CLOUDS AT FLIGHT LEVEL THREE ONE ZERO, BOEING 707.

EXAMPLE:

FROM FIVE ZERO MILES SOUTH OF ALBUQUERQUE TO THREE ZERO MILES NORTH OF PHOENIX, 1250Z, OCCASIONAL MODERATE CHOP AT FLIGHT LEVEL THREE THREE ZERO, DC8.

b. Duration and classification of intensity should be made using the following table:

TURBULENCE REPORTING CRITERIA TABLE

INTENSITY	AIRCRAFT REACTION	REACTION INSIDE AIRCRAFT	REPORTING TERM-DEFINITION
Light	Turbulence that momentarily causes slight, erratic changes in altitude and/or attitude (pitch, roll, yaw). Report as **Light Turbulence**;* or Turbulence that causes slight, rapid and somewhat rhythmic bumpiness without appreciable changes in altitude or attitude. Report as **Light Chop**.	Occupants may feel a slight strain against seat belts or shoulder straps. Unsecured objects may be displaced slightly. Food service may be conducted and little or no difficulty is encountered in walking.	Occasional – Less than 1/3 of the time. Intermittent – 1/3 to 2/3. Continuous – More than 2/3.
Moderate	Turbulence that is similar to Light Turbulence but of greater intensity. Changes in altitude and/or attitude occur but the aircraft remains in positive control at all times. It usually causes variations in indicated airspeed. Report as **Moderate Turbulence**;* or Turbulence that is similar to Light Chop but of greater intensity. It causes rapid bumps or jolts without appreciable changes in aircraft altitude or attitude. Report as **Moderate Chop**.	Occupants feel definite strains against seat belts or shoulder straps. Unsecured objects are dislodged. Food service and walking are difficult.	**NOTE** 1. Pilots should report location(s), time (UTC), intensity, whether in or near clouds, altitude, type of aircraft and, when applicable, duration of turbulence. 2. Duration may be based on time between two locations or over a single location. All locations should be readily identifiable. EXAMPLES: a. Over Omaha, 1232Z, Moderate Turbulence, in cloud, Flight Level 310, B707. b. From 50 miles south of Albuquerque to 30 miles north of Phoenix, 1210Z to 1250Z, occasional Moderate Chop, Flight Level 330, DC8.
Severe	Turbulence that causes large, abrupt changes in altitude and/or attitude. It usually causes large variations in indicated airspeed. Aircraft may be momentarily out of control. Report as **Severe Turbulence**.*	Occupants are forced violently against seat belts or shoulder straps. Unsecured objects are tossed about. Food service and walking are impossible.	
Extreme	Turbulence in which the aircraft is violently tossed about and is practically impossible to control. It may cause structural damage. Report as **Extreme Turbulence**.*		

* High level turbulence (normally above 15,000 feet ASL) not associated with cumuliform cloudiness, including thunderstorms, should be reported as CAT (clear air turbulence) preceded by the appropriate intensity, or light or moderate chop.

523. WIND SHEAR PIREPS

a. Because unexpected changes in wind speed and direction can be hazardous to aircraft operations at low altitudes on approach to and departing from airports, pilots are urged to promptly volunteer reports to controllers of wind shear conditions they encounter. An advance warning of this information will assist other pilots in avoiding or coping with a wind shear on approach or departure.

b. When describing conditions, use of the terms "negative" or "positive" wind shear should be avoided. PIREPs of "*negative* wind shear on final," intended to describe loss of airspeed and lift, have been interpreted to mean that *no* wind shear was encountered. The recommended method for wind shear reporting is to state the loss or gain of airspeed and the altitudes at which it was encountered.

EXAMPLE:

DENVER TOWER, CESSNA 1234 ENCOUNTERED WIND SHEAR, LOSS OF 20 KNOTS AT 400 FEET.

EXAMPLE:

TULSA TOWER, AMERICAN 721 ENCOUNTERED WIND SHEAR ON FINAL, GAINED 25 KNOTS BETWEEN 600 AND 400 FEET FOLLOWED BY LOSS OF 40 KNOTS BETWEEN 400 FEET AND SURFACE.

(1) Pilots who are not able to report wind shear in these specific terms are encouraged to make reports in terms of the effect upon their aircraft.

EXAMPLE:

MIAMI TOWER, GULFSTREAM 403 CHARLIE ENCOUNTERED AN ABRUPT WIND SHEAR AT 800 FEET ON FINAL, MAX THRUST REQUIRED.

(2) Pilots using Inertial Navigation Systems should report the wind and altitude both above and below the shear level.

524. CLEAR AIR TURBULENCE (CAT) PIREPS

CAT has become a very serious operational factor to flight operations at all levels and especially to jet traffic flying in excess of 15,000 feet. The best available information on this phenomena must come from pilots via the PIREP reporting procedures. All pilots encountering CAT conditions are urgently requested to report *time, location* and *intensity* (light, moderate, severe or extreme) of the element to the FAA facility with which they are maintaining radio contact. If time and conditions permit, elements should be reported according to the standards for other

PIREPs and position reports. (See PARA—522 - PIREPS RELATING TO TURBULENCE.)

525. MICROBURSTS

a. Relatively recent meteorological studies have confirmed the existence of microburst phenomena. Microburst are small-scale intense downdrafts which, on reaching the surface, spread outward in all directions from the downdraft center. This causes the presence of both vertical and horizontal wind shears that can be extremely hazardous to all types and categories of aircraft, especially at low altitudes. Due to their small size, short life-span, and the fact that they can occur over areas without surface precipitation, microbursts are not easily detectable using conventional weather radar or wind shear alert systems.

b. Parent clouds producing microburst activity can be any of the low or middle layer convective cloud types. Note, however, that microbursts commonly occur within the heavy rain portion of thunderstorms, and in much weaker, benign-appearing convective cells that have little or no precipitation reaching the ground.

c. The life cycle of a microburst as it descends in a convective rain shaft is seen in Figure 1. An important consideration for pilots is the fact that the microburst intensifies for about 5 minutes after it strikes the ground.

d. Characteristics of microbursts include:

(1) Size — The microburst downdraft is typically less than 1 mile in diameter as it descends from the cloud base to about 1,000 - 3,000 feet above the ground. In the transition zone near the ground, the downdraft changes to a horizontal outflow that can extend to approximately 2 1/2 miles in diameter.

(2) Intensity — The downdrafts can be as strong as 6,000 feet per minute. Horizontal winds near the surface can be as strong as 45 knots resulting in a 90 knot shear (headwind to tailwind change for a traversing aircraft) across the microburst. These strong horizontal winds occur within a few hundred feet of the ground.

(3) Visual Signs — Microbursts can be found almost anywhere that there is convective activity. They may be embedded in heavy rain associated with a thunderstorm or in light rain in benign-appearing virga. When there is little or no precipitation at the surface accompanying the microburst, a ring of blowing dust may be the only visual clue of its existence.

(4) Duration — An individual microburst will seldom last longer than 15 minutes from the time it strikes the ground until dissipation. The horizontal winds continue to increase during the first 5 minutes with the maximum intensity winds lasting approximately 2- 4- minutes. Sometimes microbursts are concentrated into a line structure and, under these conditions, activity may continue for as long as an hour. Once microburst activity starts, multiple microbursts in the same general area are not uncommon and should be expected.

e. Microburst wind shear may create a severe hazard for aircraft within 1,000 feet of the ground, particularly during the approach to landing and landing and take-off phases. The impact of a microburst on aircraft which have the unfortunate experience of penetrating one is characterized in Figure 2. The aircraft may encounter a headwind (performance increasing), followed by a downdraft and tailwind (both performance decreasing), possibly resulting in terrain impact.

f. Pilots should heed wind shear PIREPS, as a previous pilot's encounter with a microburst may be the only indication received. However, since the wind shear intensifies rapidly in its early stages a PIREP may not indicate the current severity of a microburst. Flight in the vicinity of suspected or reported microburst activity should always be avoided. Should a pilot encounter one, a wind shear PIREP should be made at once.

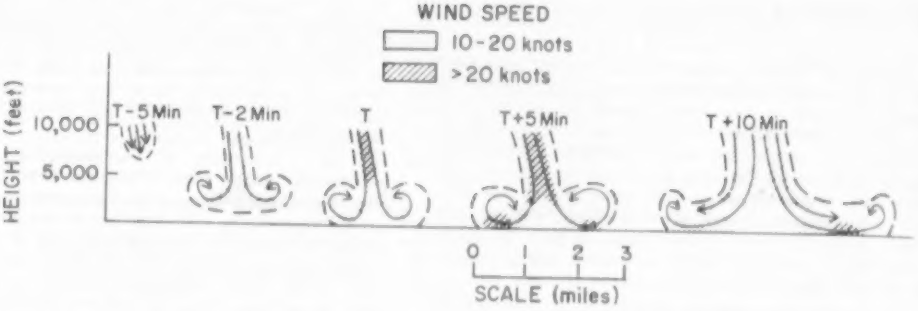

WIND SPEED
10-20 knots
>20 knots
HEIGHT (feet)
10,000
5,000
T-5 Min
T-2 Min
T
T+5 Min
T+10 Min
0
1
2
3
SCALE (miles)

Figure 1. Vertical cross section of the evolution of a microburst wind field. T is the time of initial divergence at the surface. The shading refers to the vector wind speeds. Figure adapted from Wilson et al., 1984, Microburst Wind Structure and Evaluation of Doppler Radar for Wind Shear Detection, DOT/FAA Report No. DOT/FAA/PM-84/29, National Technical Information Service, Springfield, VA 37 pp.

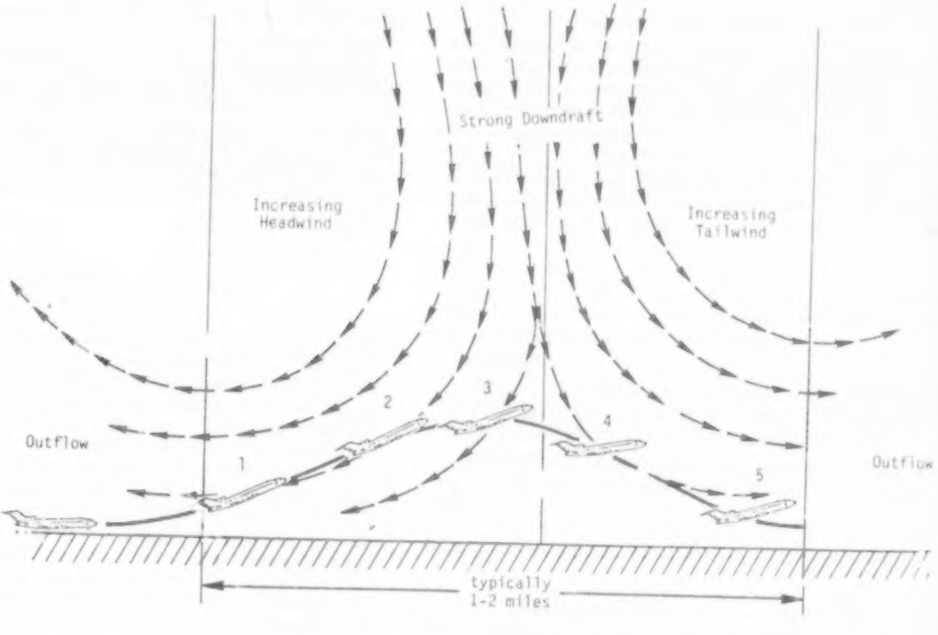

Strong Downdraft
Increasing Headwind
Increasing Tailwind
Outflow
Outflow
1
2
3
4
5
typically 1-2 miles

Figure 2. A microburst encounter during takeoff. The airplane first encounters a headwind and experiences increasing performance (1), this is followed in short succession by a decreasing headwind component (2), a downdraft (3), and finally a strong tailwind (4), where 2 through 5 all result in decreasing performance of the airplane. Position (5) represents an extreme situation just prior to impact. Figure courtesy of Walter Frost, FWG Associates, Inc., Tullahoma, Tennessee.

526. THUNDERSTORMS

a. Turbulence, hail, rain, snow, lightning, sustained updrafts and downdrafts, icing conditions — all are present in thunderstorms. While there is some evidence that maximum turbulence exists at the middle level of a thunderstorm, recent studies show little variation of turbulence intensity with altitude.

b. There is no useful correlation between the external visual appearance of thunderstorms and the severity or amount of turbulence or hail within them. The visible thunderstorm cloud is only a portion of a turbulent system whose updrafts and downdrafts often extend far beyond the visible storm cloud. Severe turbulence can be expected up to 20 miles from severe thunderstorms. This distance decreases to about 10 miles in less severe storms.

c. Weather radar, airborne or ground based, will normally reflect the areas of moderate to heavy precipitation (radar does not detect turbulence). The frequency and severity of turbulence generally increases with the radar reflectivity which is closely associated with the areas of highest liquid water content of the storm. NO FLIGHT PATH THROUGH AN AREA OF STRONG OR VERY STRONG RADAR ECHOS SEPARATED BY 20-30 MILES OR LESS MAY BE CONSIDERED FREE OF SEVERE TURBULENCE.

d. Turbulence beneath a thunderstorm should not be minimized. This is especially true when the relative humidity is low in any layer between the surface and 15,000 feet. Then the lower altitudes may be characterized by strong out-flowing winds and severe turbulence.

e. The probability of lightning strikes occurring to aircraft is greatest when operating at altitudes where temperatures are between minus 5 degrees Celsius and plus 5 degrees Celsius. Lightning can strike aircraft flying in the clear in the vicinity of a thunderstorm.

f. The NWS recognizes only two classes of intensities of thunderstorms as applied to aviation surface weather observations:

(1) Thunderstorm T;

(2) Severe T+

g. NWS radar systems are able to objectively determine radar weather echo intensity levels by use of Video Integrator Processor (VIP) equipment. These thunderstorm intensity levels are on a scale of one to six. (See RADAR WEATHER ECHO INTENSITY LEVELS in the Pilot/Controller Glossary.)

EXAMPLE:

Alert provided by an ATC facility to an aircraft: (aircraft identification) LEVEL FIVE INTENSE WEATHER ECHO BETWEEN TEN O'CLOCK AND TWO O'CLOCK, ONE ZERO MILES MOVING EAST AT TWO ZERO KNOTS, TOP FLIGHT LEVEL THREE NINE ZERO.

EXAMPLE:

Alert provided by a FSS: (aircraft identification) LEVEL FIVE INTENSE WEATHER ECHO TWO ZERO MILES WEST OF ATLANTA VOR TWO FIVE MILES WIDE, MOVING EAST AT TWO ZERO KNOTS, TOPS FLIGHT LEVEL THREE NINE ZERO.

527. THUNDERSTORM FLYING

a. Above all, remember this: never regard any thunderstorm "lightly" even when radar observers report the echoes are of light intensity. Avoiding thunderstorms is the best policy. Following are some Do's and Don'ts of thunderstorm avoidance:

(1) Don't land or takeoff in the face of an approaching thunderstorm. A sudden gust front of low level turbulence could cause loss of control.

(2) Don't attempt to fly under a thunderstorm even if you can see through to the other side. Turbulence and wind shear under the storm could be disastrous.

(3) Don't fly without airborne radar into a cloud mass containing scattered embedded thunderstorms. Scattered thunderstorms not embedded usually can be visually circumnavigated.

(4) Don't trust the visual appearance to be a reliable indicator of the turbulence inside a thunderstorm.

(5) Do avoid by at least 20 miles any thunderstorm identified as severe or giving an intense radar echo. This is especially true under the anvil of a large cumulonimbus.

(6) Do clear the top of a known or suspected severe thunderstorm by at least 1,000 feet altitude for each 10 knots of wind speed at the cloud top. This should exceed the altitude capability of most aircraft.

(7) Do circumnavigate the entire area if the area has 6/10 thunderstorm coverage.

(8) Do remember that vivid and frequent lightning indicates the probability of a severe thunderstorm.

(9) Do regard as extremely hazardous any thunderstorm with tops 35,000 feet or higher whether the top is visually sighted or determined by radar.

b. If you cannot avoid penetrating a thunderstorm, following are some Do's *before* entering the storm:

(1) Tighten your safety belt, put on your shoulder harness if you have one and secure all loose objects.

(2) Plan and hold your course to take you through the storm in a minimum time.

(3) To avoid the most critical icing, establish a penetration altitude below the freezing level or above the level of minus 15 degrees Celsius.

(4) Verify that pitot heat is on and turn on carburetor heat or jet engine anti-ice. Icing can be rapid at any altitude and cause almost instantaneous power failure and/or loss of airspeed indication.

(5) Establish power settings for turbulence penetration airspeed recommended in your aircraft manual.

(6) Turn up cockpit lights to highest intensity to lessen temporary blindness from lightning.

(7) If using automatic pilot, disengage altitude hold mode and speed hold mode. The automatic altitude and speed controls will increase maneuvers of the aircraft thus increasing structural stress.

(8) If using airborne radar, tilt the antenna up and down occasionally. This will permit you to detect other thunderstorm activity at altitudes other than the one being flown.

c. Following are some Do's and Don'ts *during* the thunderstorm penetration:

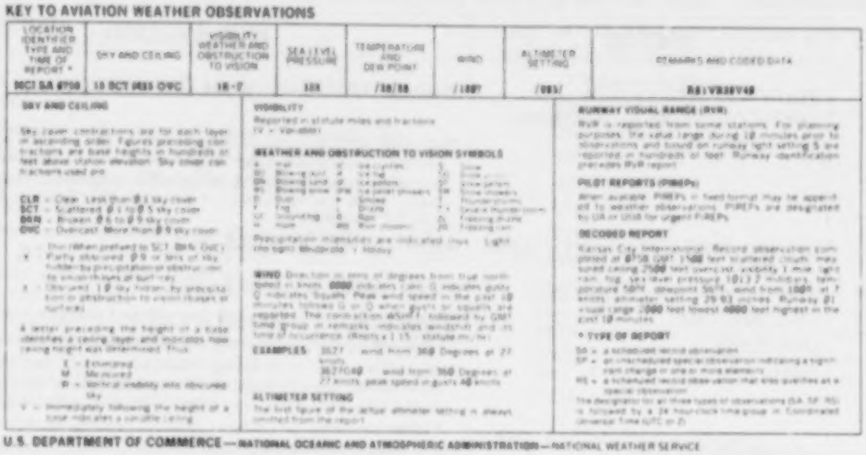
(1) Do keep your eyes on your instruments. Looking outside the cockpit can increase danger of temporary blindness from lightning.

(2) Don't change power settings; maintain settings for the recommended turbulence penetration airspeed.

(3) Do maintain constant attitude; let the aircraft "ride the waves." Manuevers in trying to maintain constant altitude increases stress on the aircraft.

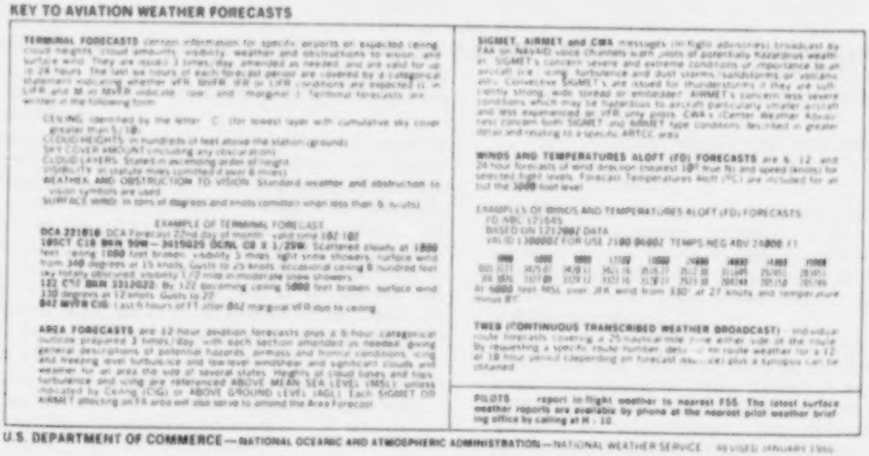
(4) Don't turn back once you are in the thunderstorm. A straight course through the storm most likely will get you out of the hazards most quickly. In addition, turning maneuvers increase stress on the aircraft.

528. KEY TO AVIATION WEATHER OBSERVATIONS AND FORECASTS



KEY TO AVIATION WEATHER OBSERVATIONS

U.S. DEPARTMENT OF COMMERCE — NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION — NATIONAL WEATHER SERVICE



KEY TO AVIATION WEATHER FORECASTS

U.S. DEPARTMENT OF COMMERCE — NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION — NATIONAL WEATHER SERVICE — REVISED JANUARY 1980

529. AUTOB DECODING KEY

DECODING OBSERVATIONS FROM AUTOB STATIONS

EXAMPLE: **ENV AUTOB E25 BKN BV7 P 33/29/3606/975 PK WND 08 001**

ENCODE	DECODE	EXPLANATION
ENV	STATION IDENTIFICATION:	(Wendover, UT) Identifies report using FAA identifiers.
AUTOB	AUTOMATIC STATION IDENTIFIER	
E25 BKN	SKY & CEILING:	(Estimated 2500 ft. broken) Figures are height in 100s of feet above ground. Contraction after height is amount of sky cover. Letter preceding height indicates ceiling. WX reported if visibility is less than 2 miles and no clouds are detected. *NO CLOUDS REPORTED ABOVE 6000 FEET.*
BV7	BACKSCATTER VISIBILITY AVERAGED IN PAST MINUTE:	Reported in whole miles from 1 to 7.
P	PRECIPITATION OCCURRENCE:	(P = precipitation in past 10 minutes).
33	TEMPERATURE:	(33 degrees F.) Minus sign indicates sub-zero temperatures.
/29	DEW POINT:	(29 degrees F.) Minus sign indicates sub-zero temperatures.
/3606	WIND:	(360 degrees true at 6 knots) Direction is first two digits and is reported in tens of degrees. To decode, add a zero to first two digits. The last digits are speed; e.g., 2524 = 250 degrees at 24 knots.
/975	ALTIMETER SETTING:	(29.75 inches) The tens digit and decimal are omitted from report. To decode, prefix a 2 to code if it begins with 8 or 9. Otherwise, prefix a 3; e.g., 982 = 29.82, 017 = 30.17.
PK WND 08	PEAK WIND SPEED:	(8 knots) Reported speed is highest detected since last hourly observation.
001	PRECIPITATION ACCUMULATION:	(0.01 inches) Amount of precipitation since last synoptic time (00, 06, 12, 1800 UTC).

NOTE: If no clouds are detected below 6,000 feet and the visibility is greater than 2 miles, the reported sky condition will be *CLR BLO 60.*

Section 2. ALTIMETER SETTING PROCEDURES

530. GENERAL

a. The accuracy of aircraft altimeters is subject to the following factors:

(1) Nonstandard temperatures of the atmosphere.

(2) Aircraft static pressure systems (position error).

(3) Nonstandard atmospheric pressure, and

(4) Instrument error.

b. Pilots should disregard the effect of nonstandard atmospheric temperatures and pressures except that low temperatures and pressures need to be considered for terrain clearance purposes.

NOTE.— Standard temperature at sea level is 15 degrees Celsius (59 degrees Fahrenheit). The temperature gradient from sea level is 2 degrees Celsius (3.6 degrees Fahrenheit) per 1,000 feet. Pilots should apply corrections for static pressure systems and/or instruments, if appreciable errors exist.

c. Experience gained through volume of operations has led to the adoption of a standard altimeter setting for flights operating in the higher altitudes. A standard setting eliminates altitude conflicts caused by altimeter settings derived from different geographical sources. In addition, it eliminates station barometer errors and some of the altimeter instrument errors.

531. PROCEDURES

a. The cruising altitude or flight level of aircraft shall be maintained by reference to an altimeter which shall be set, when operating:

(1) **Below 18,000 feet MSL —** to the current reported altimeter setting of a station along the route and within 100 NM of the aircraft, or if there is no station within this area, the current reported altimeter setting of an appropriate available station. When an aircraft is en route on an instrument flight plan, the ATC controller will furnish this information to the pilot at least once while the aircraft is in his area of jurisdiction. In the case of an aircraft not equipped with a radio, set to the elevation of the departure airport or use an appropriate altimeter setting available prior to departure.

(2) **At or above 18,000 feet MSL —** to 29.92 inches of mercury (standard setting). The lowest usable flight level is determined by the atmospheric pressure in the area of operation as shown in the following table:

Altimeter Setting (Current Reported)...	Lowest usable flight level
29.92 or higher	180
29.91 to 29.42	185
29.41 to 28.92	190
28.91 to 28.42	195
28.41 to 27.92	200

(3) Where the minimum altitude, as prescribed in FAR—91.109 and FAR—91.119, is above 18,000 feet MSL, the lowest usable flight level shall be the flight level equivalent of the minimum altitude plus the number of feet specified in the following table:

Altimeter Setting...	Correction Factor
29.92 or higher	none
29.91 to 29.42	500 Feet
29.41 to 28.92	1000 Feet
28.91 to 28.42	1500 Feet
28.41 to 27.92	2000 Feet
27.91 to 27.42	2500 Feet

EXAMPLE:

The minimum safe altitude of a route is 19,000 feet MSL and the altimeter setting is reported between 29.92 and 29.42 inches of mercury, the lowest usable flight level will be 195, which is the flight level equivalent of 19,500 feet MSL (minimum altitude plus 500 feet).

532. ALTIMETER ERRORS

a. Most pressure altimeters are subject to mechanical, elastic, temperature, and installation errors. (Detailed information regarding the use of pressure altimeters is found in the Instrument Flying Handbook, Chapter IV.) Although manufacturing and installation specifications, as well as the periodic test and inspections required by regulations (Far 43, Appendix E), act to reduce these errors, any scale error may be observed in the following manner:

(1) Set the current reported altimeter setting on the altimeter setting scale.

(2) Altimeter should now read field elevation if you are located on the same reference level used to establish the altimeter setting.

(3) Note the variation between the known field elevation and the altimeter indication. If this variation is in the order of plus or minus 75 feet, the accuracy of the altimeter is questionable and the problem should be referred to an appropriately rated repair station for evaluation and possible correction.

b. Once in flight, it is very important to frequently obtain current altimeter settings en route. If you do not reset your altimeter when flying *from* an area of high pressure or high temperatures *into* an area of low pressures or low temperature, *your aircraft will be closer to the surface than the altimeter indicates.* An inch error on the altimeter equals 1,000 feet of altitude. To quote an old saying: **"GOING FROM A HIGH TO A LOW, LOOK OUT BELOW."**

c. A reverse situation, without resetting the altimeter when going from a low temperature or low pressure area into a high temperature or high pressure area, the aircraft will be higher than the altimeter indicates.

d. The possible results of the above situations is obvious, particularly if operating at the minimum altitude or when conducting an instrument approach. If the altimeter is in error, you may still be on instruments when reaching

the minimum altitude (as indicated on the altimeter), whereas you might have been in the clear and able to complete the approach if the altimeter setting was correct.

533. HIGH BAROMETRIC PRESSURE

a. Cold, dry air masses may produce barometric pressures in excess of 31.00 inches of Mercury. Most altimeters do not have an accurate means of being adjusted for altimeter settings of these levels.

b. The altimeter setting announced by air traffic controllers will be 31.00 inches of Mercury (Three One Zero Zero) when the barometric pressure equals or exceeds that value. Actual barometric pressure will be provided upon request.

c. The altimeter error caused by the high pressure will be in the opposite direction to the error caused by the cold temperature.

534—539. RESERVED

Section 3. WAKE TURBULENCE

540. GENERAL

a. Every aircraft generates a wake while in flight. Initially, when pilots encountered this wake in flight, the disturbance was attributed to "prop wash." It is known, however, that this disturbance is caused by a pair of counter rotating vortices trailing from the wing tips. The vortices from large aircraft pose problems to encountering aircraft. For instance, the wake of these aircraft can impose rolling movements exceeding the roll control capability of some aircraft. Further, turbulence generated within the vortices can damage aircraft components and equipment if encountered at close range. The pilot must learn to envision the location of the vortex wake generated by large aircraft and adjust his flight path accordingly.

b. During ground operations and during takeoff, jet engine blast (thrust stream turbulence) can cause damage and upsets if encountered at close range. Exhaust velocity versus distance studies at various thrust levels have shown a need for light aircraft to maintain an adequate separation behind large turbojet aircraft. Below are examples of the distance requirements to avoid exhaust velocities of greater than 25 mph:

25 MPH VELOCITY	*B-727*	*DC-8*	*DC−10 / L−1011*	*B−747, B−767, B−757, A−300, and all re-engined B−707 / DC−8 aircraft*
Takeoff Thrust	550 Ft.	700 Ft.	2,100 Ft.	1,752 Ft.
Breakaway Thrust	200 Ft.	400Ft.	850 Ft.	1,250 Ft.
Idle Thrust	150 Ft.	100 Ft.	350 Ft.	620 Ft.

c. Operators of light aircraft can minimize their exposure to jet blast by:

(1) Holding well back of the runway edge or taxiway hold line to avoid the drifting turbulence;

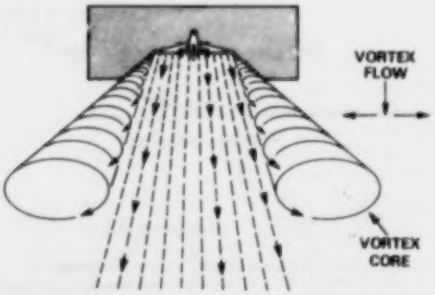
(2) Aligning the aircraft to face the possible jet blast; and

(3) Ensuring adequate separation when landing or taking off behind a departing large jet aircraft.

Pilots of large aircraft should be particularly careful to consider the effects of their jet blasts on other aircraft.

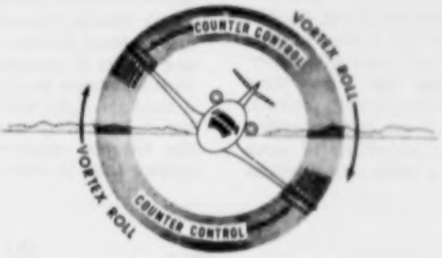
541. VORTEX GENERATION

Lift is generated by the creation of a pressure differential over the wing surface. The lowest pressure occurs over the upper wing surface and the highest pressure under the wing. This pressure differential triggers the roll up of the airflow aft of the wing resulting in swirling air masses trailing downstream of the wing tips. After the roll up is completed, the wake consists of two counter rotating cylindrical vortices.



542. VORTEX STRENGTH

a. The strength of the vortex is governed by the weight, speed, and shape of the wing of the generating aircraft. The vortex characteristics of any given aircraft can also be changed by extension of flaps or other wing configuring devices as well as by change in speed. However, as the basic factor is weight, the vortex strength increases proportionately. During tests, peak vortex tangential velocities were recorded at 224 feet per second, or about 133 knots. The greatest vortex strength occurs when the generating aircraft is HEAVY, CLEAN, and SLOW.



b. INDUCED ROLL

(1) In rare instances a wake encounter could cause in-flight structural damage of catastrophic proportions. However, the usual hazard is associated with induced rolling movements which can exceed the rolling capability of the encountering aircraft. In flight experiments, aircraft have been intentionally flown directly up trailing vortex cores of large aircraft. It was shown that the capability of an aircraft to counteract the roll imposed by the wake vortex primarily depends on the wing span and counter responsiveness of the encountering aircraft.

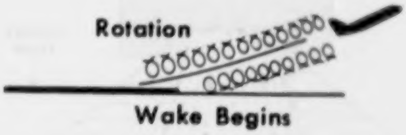
(2) Counter control is usually effective and induced roll minimal in cases where the wing span and ailerons of the encountering aircraft extend beyond the rotational flow field of the vortex. It is more difficult for aircraft with short wing span (relative to the generating aircraft) to counter the imposed roll induced by vortex flow. Pilots of short span aircraft, even of the high performance type, must be especially alert to vortex encounters.

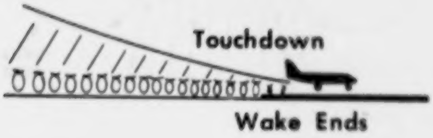
(3) The wake of large aircraft requires the respect of all pilots.

543. VORTEX BEHAVIOR

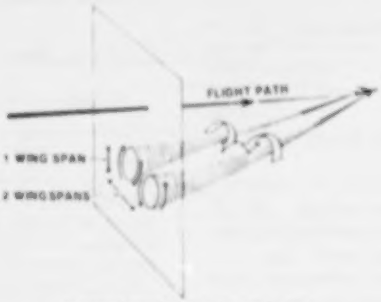
a. Trailing vortices have certain behavioral characteristics which can help a pilot visualize the wake location and thereby take avoidance precautions.

(1) Vortices are generated from the moment aircraft leave the ground, since trailing vortices are a by-product of wing lift. Prior to takeoff or touchdown pilots should note the rotation or touchdown point of the preceding aircraft.



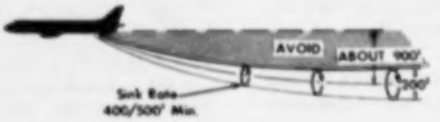


(2) The vortex circulation is outward, upward and around the wing tips when viewed from either ahead or behind the aircraft. Tests with large aircraft have shown that the vortex flow field, in a plane cutting through the wake at any point downstream, covers an area about 2 wing spans in width and one wing span in depth. The vortices remain so spaced (about a wing span apart) even drifting with the wind, at altitudes greater than a wing span from the ground. In view of this, if persistent vortex turbulence is encountered, a slight change of altitude and lateral position (preferably upwind) will provide a flight path clear of the turbulence.

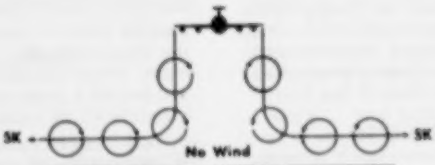


Vortex Flow Field in Aircraft Wake

(3) Flight tests have shown that the vortices from large aircraft sink at a rate of about 400 to 500 feet per minute. They tend to level off at a distance about 900 feet below the flight path of the generating aircraft. Vortex strength diminishes with time and distance behind the generating aircraft. Atmospheric turbulence hastens breakup. Pilots should fly at or above the large aircraft's flight path, altering course as necessary to avoid the area behind and below the generating aircraft.



(4) When the vortices of large aircraft sink close to the ground (within about 200 feet), they tend to move laterally over the ground at a speed of about 5 knots.

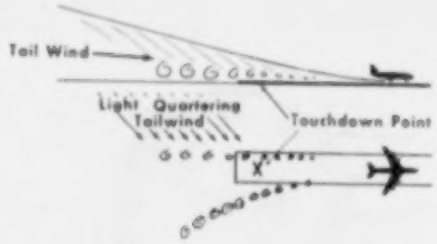


Vortex Movement in Ground Effect - No Wind

b. A crosswind will decrease the lateral movement of the upwind vortex and increase the movement of the downwind vortex. Thus a light wind of 3 to 7 knots could result in the upwind vortex remaining in the touchdown zone for a period of time and hasten the drift of the downwind vortex toward another runway. Similarly, a tailwind condition can move the vortices of the preceding aircraft forward into the touchdown zone. THE LIGHT QUARTER-

ING TAILWIND REQUIRES MAXIMUM CAUTION.

Pilots should be alert to large aircraft upwind from their approach and takeoff flight paths.



544. OPERATIONS PROBLEM AREAS

a. A wake encounter is not necessarily hazardous. It can be one or more jolts with varying severity depending upon the direction of the encounter, distance from the generating aircraft, and point of vortex encounter. The probability of induced roll increases when the encountering aircraft's heading is generally aligned with the vortex trail or flight path of the generating aircraft.

b. AVOID THE AREA BELOW AND BEHIND THE GENERATING AIRCRAFT, ESPECIALLY AT LOW ALTITUDE WHERE EVEN A MOMENTARY WAKE ENCOUNTER COULD BE HAZARDOUS.

c. Pilots should be particularly alert in calm wind conditions and situations where the vortices could:

(1) Remain in the touchdown area.

(2) Drift from aircraft operating on a nearby runway.

(3) Sink into the takeoff or landing path from a crossing runway.

(4) Sink into the traffic patterns from other airport operations.

(5) Sink into the flight path of VFR flights operating at 500 feet AGL and below.

d. Pilots of all aircraft should visualize the location of the vortex trail behind large aircraft and use proper vortex avoidance procedures to achieve safe operation. It is equally important that pilots of large aircraft plan or adjust their flight paths to minimize vortex exposure to other aircraft.

545. VORTEX AVOIDANCE PROCEDURES

a. Under certain conditions, airport traffic controllers apply procedures for separating aircraft from heavy jet aircraft. The controllers will also provide VFR aircraft, with whom they are in communication and, which in the tower's opinion may be adversely affected by wake turbulence from a large aircraft, the position, altitude and direction of flight of the large aircraft followed by the phrase "CAUTION — WAKE TURBULENCE." WHETHER OR NOT A WARNING HAS BEEN GIVEN, HOWEVER, THE PILOT IS EXPECTED TO ADJUST HIS OPERATIONS AND FLIGHT PATH AS NECESSARY TO PRECLUDE SERIOUS WAKE ENCOUNTERS.

b. The following vortex avoidance procedures are recommended for the various situations:

(1) Landing behind a large aircraft — same runway: Stay at or above the large aircraft's final approach flight path — note his touchdown point — land beyond it.

(2) Landing behind a large aircraft — when parallel runway is closer than 2,500 feet: Consider possible drift to your runway. Stay at or above the large aircraft's final approach flight path — note his touchdown point.

(3) Landing behind a large aircraft — crossing runway: Cross above the large aircraft's flight path.

(4) Landing behind a departing large aircraft — same runway: Note the large aircraft's rotation point — land well prior to rotation point.

(5) Landing behind a departing large aircraft — crossing runway: Note the large aircraft's rotation point — if past the intersection — continue the approach — land prior to the intersection. If large aircraft rotates prior to the intersection, avoid flight below the large aircraft's flight path. Abandon the approach unless a landing is assured well before reaching the intersection.

(6) Departing behind a large aircraft: Note the large aircraft's rotation point — rotate prior to large aircraft's rotation point — continue climb above and stay upwind of the large aircraft's climb path until turning clear of his wake. Avoid subsequent headings which will cross below and behind a large aircraft. Be alert for any critical takeoff situation which could lead to a vortex encounter.

(7) Intersection takeoffs — same runway: Be alert to adjacent large aircraft operations particularly upwind of your runway. If intersection takeoff clearance is received, avoid subsequent heading which will cross below a large aircraft's path.

(8) Departing or landing after a large aircraft executing a low approach, missed approach or touch-and-go landing: Because vortices settle and move laterally near the ground, the vortex hazard may exist along the runway and in your flight path after a large aircraft has executed a low approach, missed approach or a touch-and-go landing, particular in light quartering wind conditions. You should assure that an interval of at least 2 minutes has elapsed before your takeoff or landing.

(9) En route VFR (thousand-foot altitude plus 500 feet): Avoid flight below and behind a large aircraft's path. If a large aircraft is observed above on the same track (meeting or overtaking) adjust your position laterally, preferably upwind.

546—549. RESERVED

550. HELICOPTERS

A hovering helicopter generates a downwash from its main rotor(s) similar to the prop blast of a conventional aircraft. However, in forward flight, this energy is transformed into a pair of trailing vortices similar to wing-tip vortices of fixed wing aircraft. Pilots of small aircraft should avoid the vortices as well as the downwash.

551. PILOT RESPONSIBILITY

a. Government and industry groups are making concerted efforts to minimize or eliminate the hazards of trailing vortices. However, the flight disciplines necessary to assure vortex avoidance during VFR operations must be exercised by the pilot. Vortex visualization and avoidance procedures should be exercised by the pilot using the same degree of concern as in collision avoidance.

b. Wake turbulence may be encountered by aircraft in flight as well as when operating on the airport movement area. (See WAKE TURBULENCE in the Pilot/Controller Glossary.)

c. Pilots are reminded that in operations conducted behind all aircraft, acceptance of instructions from ATC in the following situations is an acknowledgment that the pilot will ensure safe takeoff and landing intervals and accepts the responsibility of providing his own wake turbulence separation.

(1) Traffic information,

(2) Instructions to follow an aircraft, and

(3) The acceptance of a visual approach clearance.

d. For operations conducted behind heavy aircraft, ATC will specify the word "heavy" when this information is known. Pilots of heavy aircraft should always use the word "heavy" in radio communications.

552. AIR TRAFFIC WAKE TURBULENCE SEPARATIONS

a. Because of the possible effects of wake turbulence, controllers are required to apply no less than specified minimum separation for aircraft operating behind a heavy jet and, in certain instances, behind large nonheavy aircraft.

(1) Separation is applied to aircraft operating directly behind a heavy jet at the same altitude or less than 1,000 feet below:

(a) Heavy jet behind heavy jet — 4 miles.

(b) Small/large aircraft behind heavy jet — 5 miles.

(2) Also, separation, measured at the time the preceding aircraft is over the landing threshold, is provided to small aircraft:

(a) Small aircraft landing behind heavy jet — 6 miles.

(b) Small aircraft landing behind large aircraft - 4 miles.

NOTE.— See Aircraft Classes in Pilot/Controller Glossary.

(3) Additionally, appropriate time or distance intervals are provided to departing aircraft:

(a) Two minutes or the appropriate 4 or 5 mile radar separation when takeoff behind a heavy jet will be:

- from the same threshold

- on a crossing runway and projected flight paths will cross

- from the threshold of a parallel runway when staggered ahead of that of the adjacent runway by less than 500 feet and when the runways are separated by less than 2,500 feet.

NOTE.— Pilots, after considering possible wake turbulence effects, may specifically request waiver of the 2-minute interval by stating, "request waiver of 2-minute interval" or a similar statement. Controllers may acknowledge this statement as pilot acceptance of responsibility for wake turbulence separation and, if traffic permits, issue takeoff clearance.

b. A 3-minute interval will be provided when a small aircraft will takeoff:

(1) From an intersection on the same runway (same or opposite direction) behind a departing large aircraft,

(2) In the opposite direction on the same runway behind a large aircraft takeoff or low/missed approach.

NOTE.— This 3-minute interval may be waived upon specific pilot request.

c. A 3-minute interval will be provided for all aircraft taking off when the operations are as described in b(1) and (2) above, the preceding aircraft is a heavy jet, and the operations are on either the same runway or parallel runways separated by less than 2,500 feet. Controllers may not reduce or waive this interval.

d. Pilots may request additional separation i.e., 2 minutes instead of 4 or 5 miles for wake turbulence avoidance. This request should be made as soon as practical on ground control and at least before taxiing onto the runway.

NOTE.— FAR 91.3(a) states: "The pilot in command of an aircraft is directly responsible for and is the final authority as to the operation of that aircraft."

553—559. RESERVED

NOTES

SECTION 4. BIRD HAZARDS, AND FLIGHT OVER NATIONAL REFUGES, PARKS, AND FORESTS

560. MIGRATORY BIRD ACTIVITY

a. Bird strike risk increases because of bird migration during the months of March through April, and August through November.

b. The altitudes of migrating birds vary with winds aloft, weather fronts, terrain elevations, cloud conditions, and other environmental variables. While over 90 percent of the reported bird strikes occur at or below 3,000 feet AGL, strikes at higher altitudes are common during migration. Ducks and geese are frequently observed up to 7,000 feet AGL and pilots are cautioned to minimize en route flying at lower altitudes during migration.

c. Considered the greatest potential hazard to aircraft because of their size, abundance, or habit of flying in dense flocks are gulls, waterfowl, vultures, hawks, owls, egrets, blackbirds, and starlings. Four major migratory flyways exist in the United States. The Atlantic flyway parallels the Atlantic Coast. The Mississippi Flyway stretches from Canada through the Great Lakes and follows the Mississippi River. The Central Flyway represents a broad area east of the Rockies, stretching from Canada through Central America. The Pacific Flyway follows the west coast and overflies major parts of Washington, Oregon, and California. There are also numerous smaller flyways which cross these major north-south migratory routes.

561. REDUCING BIRD STRIKE RISKS

a. The most serious strikes are those involving ingestion into an engine (turboprops and turbine jet engines) or windshield strikes. These strikes can result in emergency situations requiring prompt action by the pilot.

b. Engine ingestions may result in sudden loss of power or engine failure. Review engine out procedures, especially when operating from airports with known bird hazards or when operating near high bird concentrations.

c. Windshield strikes have resulted in pilots experiencing confusion, disorientation, loss of communications, and aircraft control problems. Pilots are encouraged to review their emergency procedures before flying in these areas.

d. When encountering birds en route, climb to avoid collision, because birds in flocks generally distribute themselves downward, with lead birds being at the highest altitude.

e. Avoid overflight of known areas of bird concentration and flying at low altitudes during bird migration. Charted wildlife refuges and other natural areas contain unusually high local concentration of birds which may create a hazard to aircraft.

562. REPORTING BIRD STRIKES

Pilots are urged to report strikes using FAA Form 5200-7, Bird Strike/Incident Report. This form is available at any FSS, General Aviation District Office, Air Carrier District Office, or at an FAA Regional Office. The data derived from these reports is used to develop standards to cope with this extensive hazard to aircraft and for documentation of necessary habitat control on airports.

563. REPORTING BIRD AND OTHER WILDLIFE ACTIVITIES

If you observe birds or other animals on or near the runway, request airport management to disperse the wildlife before taking off. Also contact th[illegible] FAA ARTCC, FSS, or tower (including non-Fe[illegible]) regarding large flocks of birds and report the:

(1) Geographic location

(2) Bird type (geese, ducks, gulls, etc.)

(3) Approximate numbers

(4) Altitude

(5) Direction of bird flight path

564. PILOT ADVISORIES ON BIRD AND OTHER WILDLIFE HAZARDS

Many airports advise pilots of other wildlife hazards caused by large animals on the runway through the Airport/Facility Directory and the NOTAM system. Collisions of landing and departing aircraft and animals on the runway are increasing and are not limited to rural airports. These accidents have also occurred at several major airports. Pilots should exercise extreme caution when warned of the presence of wildlife on and in the vicinity of airports. If you observe deer or other large animals in close proximity to movement areas, advise the FSS, tower, or airport management.

565. FLIGHTS OVER CHARTED U.S. WILDLIFE REFUGES, PARKS, AND FOREST SERVICE AREAS

a. The landing of aircraft is prohibited on lands or waters administered by the National Park Service, U.S. Fish and Wildlife Service, or U.S. Forest Service without authorization from the respective agency. Exceptions, including

(1) when forced to land due to an emergency beyond the control of the operator,

(2) at officially designated landing sites, or

(3) an approved official business of the Federal Government.

b. All aircraft are requested to maintain a minimum altitude of 2,000 feet above the *surface* of the following: National Parks, Monuments, Seashores, Lakeshores, Recreation Areas and Scenic Riverways administered by the National Park Service, National Wildlife Refuges, Big Game Refuges, Game Ranges and Wildlife Ranges administered by the U.S. Fish and Wildlife Service, and Wilderness and Primitive areas administered by the U.S. Forest Service.

NOTE.— FAA Advisory Circular 91-36, Visual Flight Rules (VFR) Flight Near Noise-Sensitive Areas, defines the *surface* of a National Park Area (including Parks, Forests, Primitive Areas, Wilderness Areas, Recreational Areas, National Seashores, National Monuments, National Lakeshores, and National Wildlife Refuge and Range Areas) as: the highest terrain within 2,000 feet laterally of the route of flight, *or* the upper-most rim of a canyon or valley.

c. Federal regulations also prohibit airdrops by parachute or other means of persons, cargo, or objects from aircraft on lands administered by the three agencies without authorization from the respective agency. Exceptions include:

(1) emergencies involving the safety of human life, or

(2) threat of serious property loss.

566-569. RESERVED.

Section 5. POTENTIAL FLIGHT HAZARDS

570. ACCIDENT CAUSE FACTORS

a. The 10 most frequent cause factors for General Aviation Accidents that involve the pilot in command are:

(1) Inadequate preflight preparation and/or planning.
(2) Failure to obtain and/or maintain flying speed.
(3) Failure to maintain direction control.
(4) Improper level off.
(5) Failure to see and avoid objects or obstructions.
(6) Mismanagement of fuel.
(7) Improper in-flight decisions or planning.
(8) Misjudgment of distance and speed.
(9) Selection of unsuitable terrain.
(10) Improper operation of flight controls.

b. This list remains relatively stable and points out the need for continued refresher training to establish a higher level of flight proficiency for all pilots. A part of the FAA's continuing effort to promote increased aviation safety is the General Aviation Accident Prevention Program. For information on Accident Prevention activities contact your nearest General Aviation or Flight Standards District Office.

c. **ALERTNESS** — Be alert at all times, especially when the weather is good. Most pilots pay attention to business when they are operating in full IFR weather conditions, but strangely, air collisions almost invariably have occurred under ideal weather conditions. Unlimited visibility appears to encourage a sense of security which is not at all justified. Considerable information of value may be obtained by listening to advisories being issued in the terminal area, even though controller workload may prevent a pilot from obtaining individual service.

d. **GIVING WAY** — If you think another aircraft is too close to you, give way instead of waiting for the other pilot to respect the right-of-way to which you may be entitled. It is a lot safer to pursue the right-of-way angle after you have completed your flight.

571. VFR IN CONGESTED AREAS

A high percentage of near midair collisions occur below 8,000 feet AGL and within 30 miles of an airport. When operating VFR in these highly congested areas, whether you intend to land at an airport within the area or are just flying through, it is recommended that extra vigilance be maintained and that you monitor an appropriate control frequency. Normally the appropriate frequency is an approach control frequency. By such monitoring action you can "get the picture" of the traffic in your area. When the approach controller has radar, radar traffic advisories may be given to VFR pilots upon request. (See PARA—162 - RADAR TRAFFIC INFORMATION SERVICE.)

572. OBSTRUCTIONS TO FLIGHT

a. Antenna Towers

Extreme caution should be exercised when flying less than 2,100 feet above ground level (AGL) because of the numerous skeletal structures (radio and television antenna towers) exceeding 1,000 feet AGL with some extending higher than 2,000 feet AGL. Most skeletal structures are supported by guy wires. The wires are difficult to see in good weather and can be totally obscured during periods of dusk and reduced visibility. These wires can extend about 1,500 feet horizontally from a structure; therefore, all skeletal structures should be avoided by at least 2,000 feet.

b. Overhead Wires

Overhead transmission and utility lines often span approaches to runways and scenic flyways such as lakes, rivers, and canyons. The supporting structures of these lines may not always be readily visible and the wires may be virtually invisible under certain conditions. Most of these installations do not meet criteria which determine them to be obstructions to air navigation and therefore do not require marking and/or lighting. The supporting structures of some overhead transmission lines are equipped with flashing strobe lights. These lights indicate wires exist between the strobed structures.

573. AVOID FLIGHT BENEATH UNMANNED BALLOONS

a. The majority of unmanned free balloons currently being operated have, extending below them, either a suspension device to which the payload or instrument package is attached, or a trailing wire antenna, or both. In many instances these balloon subsystems may be invisible to the pilot until his aircraft is close to the balloon, thereby creating a potentially dangerous situation. Therefore, good judgment on the part of the pilot dictates that aircraft should remain well clear of all unmanned free balloons and flight below them should be avoided at all times.

b. Pilots are urged to report any unmanned free balloons sighted to the nearest FAA ground facility with which communication is established. Such information will assist FAA ATC facilities to identify and flight follow unmanned free balloons operating in the airspace.

574. MOUNTAIN FLYING

a. Your first experience of flying over mountainous terrain (particularly if most of your flight time has been over the flatlands of the midwest) could be a never-to-be-forgotten nightmare if proper planning is not done and if you are not aware of the potential hazards awaiting. Those familiar section lines are not present in the mountains; those flat, level fields for forced landings are practically nonexistent; abrupt changes in wind direction and velocity occur; severe updrafts and downdrafts are common, particularly near or

above abrupt changes of terrain such as cliffs or rugged areas; even the clouds look different and can build up with startling rapidity. Mountain flying need not be hazardous if you follow the recommendations below:

b. File a flight plan. Plan your route to avoid topography which would prevent a safe forced landing. The route should be over populated areas and well known mountain passes. Sufficient altitude should be maintained to permit gliding to a safe landing in the event of engine failure.

c. Don't fly a light aircraft when the winds aloft, at your proposed altitude, exceed 35 miles per hour. Expect the winds to be of much greater velocity over mountain passes than reported a few miles from them. Approach mountain passes with as much altitude as possible. Downdrafts of from 1,500 to 2,000 feet per minute are not uncommon on the leeward side.

d. Don't fly near or above abrupt changes in terrain. Severe turbulence can be expected, especially in high wind conditions.

e. Some canyons run into a dead end. Don't fly so far up a canyon that you get trapped. ALWAYS BE ABLE TO MAKE A 180 DEGREE TURN.

f. Plan your trip for the early morning hours. As a rule, the air starts to get bad at about 10 a.m., and grows steadily worse until around 4 p.m., then gradually improves until dark. Mountain flying at night in a single engine light aircraft is asking for trouble.

g. When landing at a high altitude field, the same indicated airspeed should be used as at low elevation fields. *Remember:* that due to the less dense air at altitude, this same indicated airspeed actually results in higher true airspeed, a faster landing speed, and more important, a longer landing distance. During gusty wind conditions which often prevail at high altitude fields, a power approach and power landing is recommended. Additionally, due to the faster groundspeed, your takeoff distance will increase considerably over that required at low altitudes.

h. Effects of Density Altitude. Performance figures in the aircraft owner's handbook for length of takeoff run, horsepower, rate of climb, etc., are generally based on standard atmosphere conditions (59 degrees Fahrenheit (15 degrees Celsius), pressure 29.92 inches of mercury)at sea level. However, inexperienced pilots, as well as experienced pilots, may run into trouble when they encounter an altogether different set of conditions. This is particularly true in hot weather and at higher elevations. Aircraft operations at altitudes above sea level and at higher than standard temperatures are commonplace in mountainous areas. Such operations quite often result in a drastic reduction of aircraft performance capabilities because of the changing air density. Density altitude is a measure of air density. It is not to be confused with pressure altitude, true altitude or absolute altitude. It is not to be used as a height reference, but as a determining criteria in the performance capability of an aircraft. Air density decreases with altitude. As air density decreases, density altitude increases. The further effects of high temperature and high humidity are cumulative, resulting in an increasing high density altitude condition. High density altitude reduces all aircraft performance parameters. To the pilot, this means that the normal horsepower output is reduced, propeller efficiency is reduced and a higher true airspeed is required to sustain the aircraft throughout its operating parameters. It means an increase in runway length requirements for takeoff and landings, and decreased rate of climb. An average small airplane, for example, requiring 1,000 feet for takeoff at sea level under standard atmospheric conditions will require a takeoff run of approximately 2,000 feet at an operational altitude of 5,000 feet.

NOTE.— A turbo-charged aircraft engine provides some slight advantage in that it provides sea level horsepower up to a specified altitude above sea level.

(1) Density Altitude Advisories — at airports with elevations of 2,000 feet and higher, control towers and FSSs will broadcast the advisory "Check Density Altitude" when the temperature reaches a predetermined level. These advisories will be broadcast on appropriate tower frequencies or, where available, ATIS. FSSs will broadcast these advisories as a part of Airport Advisory Service, and on TWEB.

(2) These advisories are provided by air traffic facilities, as a reminder to pilots that high temperatures and high field elevations will cause significant changes in aircraft characteristics. The pilot retains the responsibility to compute density altitude, when appropriate, as a part of preflight duties.

NOTE.— All FSSs will compute the current density altitude upon request.

i. Mountain Wave. Many pilots go all their lives without understanding what a mountain wave is. Quite a few have lost their lives because of this lack of understanding. One need not be a licensed meteorologist to understand the mountain wave phenomenon.

(1) Mountain waves occur when air is being blown over a mountain range or even the ridge of a sharp bluff area. As the air hits the upwind side of the range, it starts to climb, thus creating what is generally a smooth updraft which turns into a turbulent downdraft as the air passes the crest of the ridge. From this point, for many miles downwind, there will be a series of downdrafts and updrafts. Satellite photos of the Rockies have shown mountain waves extending as far as 700 miles downwind of the range. Along the east coast area, such photos of the Appalachian chain have picked up the moutain wave phenomenon over a hundred miles eastward. All it takes to form a mountain wave is wind blowing across the range at 15 knots or better at an intersection angle of not less than 30 degrees.

(2) Pilots from flatland areas should understand a few things about mountain waves in order to stay out of trouble. When approaching a mountain range from the upwind side (generally the west), there will usually be a smooth updraft; therefore, it is not quite as dangerous an area as the lee of the range. From the leeward side, it is always a good idea to add an extra thousand feet or so of altitude because downdrafts can exceed the climb capability of the aircraft. Never expect an updraft when approaching a mountain chain from the leeward. Always be prepared to cope with a downdraft and turbulence.

(3) When approaching a mountain ridge from the downwind side, it is recommended that the ridge be approached at approximately a 45 degrees angle to the horizontal direction of the ridge. This permits a safer retreat from the ridge with less stress on the aircraft should severe turbulence and downdraft be experienced. If severe turbulence is encountered, simultaneously reduce power and adjust pitch until aircraft approaches maneuvering speed,

then adjust power and trim to maintain maneuvering speed and fly away from the turbulent area.

575—579. RESERVED

NOTES

Section 6. SAFETY, ACCIDENT AND HAZARD REPORTS

580. AVIATION SAFETY REPORTING PROGRAM

a. The FAA has established a voluntary Aviation Safety Reporting Program designed to stimulate the free and unrestricted flow of information concerning deficiencies and discrepancies in the aviation system. This is a positive program intended to ensure the safest possible system by identifying and correcting unsafe conditions before they lead to accidents. The primary objective of the program is to obtain information to evaluate and enhance the safety and efficiency of the present system.

b. This program applies primarily to that part of the system involving the safety of aircraft operations, including departure, en route, approach and landing operations and procedures, ATC procedures, pilot/controller communications. the aircraft movement area of the airport, and near midair collisions. Pilots, air traffic controllers, and all other members of the aviation community and the general public are asked to file written reports of any discrepancy or deficiency noted in these areas.

c. The report should give the date, time, location, persons and aircraft involved (if applicable), nature of the event, and all pertinent details.

d. To ensure receipt of this information, the program provides for the waiver of certain disciplinary actions against persons, including pilots and air traffic controllers, who file timely written reports concerning potentially unsafe incidents. To be considered timely, reports must be delivered or postmarked within 10 days of the incident unless that period is extended for good cause. Reporting forms are available at FAA facilities.

e.The FAA utilizes the National Aeronautics and Space Administration (NASA) to act as an independent third party to receive and analyze reports submitted under the program. This program is described in ADVISORY CIRCULAR—00-46.

581. AIRCRAFT ACCIDENT AND INCIDENT REPORTING

a. OCCURRENCES REQUIRING NOTIFICATION — The operator of an aircraft shall immediately, and by the most expeditious means available, notify the nearest National Transportation Safety Board (NTSB) Field Office when:

(1) An aircraft accident or any of the following listed incidents occur:

(a) Flight control system malfunction or failure;

(b) Inability of any required flight crew member to perform his normal flight duties as a result of injury or illness;

(c) Failure of structural components of a turbine engine excluding compressor and turbine blades and vanes.

(d) In-flight fire;

(e) Aircraft collide in flight.

(2) An aircraft is overdue and is believed to have been involved in an accident.

b. MANNER OF NOTIFICATION:

(1) The most expeditious method of notification to the NTSB by the operator will be determined by the circumstances existing at that time. The NTSB has advised that any of the following would be considered examples of the type of notification that would be acceptable:

(a) Direct telephone notification.

(b) Telegraphic notification.

(c) Notification to the FAA who would in turn notify the NTSB by direct communication; i.e., dispatch or telephone.

c. ITEMS TO BE NOTIFIED — The notification required above shall contain the following information, if available:

(1) Type, nationality, and registration marks of the aircraft;

(2) Name of owner and operator of the aircraft;

(3) Name of the pilot-in-command;

(4) Date and time of the accident, or incident;

(5) Last point of departure and point of intended landing of the aircraft;

(6) Position of the aircraft with reference to some easily defined geographical point;

(7) Number of persons aboard, number killed, and number seriously injured;

(8) Nature of the accident, or incident, the weatheer, and the extent of damage to the aircraft, so far as is known; and

(9) A description of any explosives, radioactive materials, or other dangerous articles carried.

d. FOLLOW UP REPORTS:

(1) The operator shall file a report on NTSB Form 6120.1 or 6120.2, available from NTSB Field Offices, or from the NTSB, Washington, D.C., 20594.

(a) Within 10 days after an accident;

(b) When, after 7 days, an overdue aircraft is still missing;

(c) A report on an incident for which notification is required as described in subparagraph a(1) shall be filed only as requested by an authorized representative of the NTSB.

(2) Each crewmember, if physically able at the time the report is submitted, shall attach a statement setting forth the facts, conditions and circumstances relating to the accident or incident as they appear to him. If the crewmember is incapacitated, he shall submit the statement as soon as he is physically able.

e. WHERE TO FILE THE REPORTS

(1) The operator of an aircraft shall file with the NTSB Field Office nearest the accident or incident any report required by this section.

(2) The NTSB Field Offices are listed under U.S. Government in the telephone directories in the following cities: Anchorage, AK; Atlanta, GA; Chicago, IL; Denver, CO; Forth Worth, TX; Kansas City, MO; Los Angeles, CA; Miami, FL; New York, NY; Seattle, WA.

582. NEAR MIDAIR COLLISION REPORTING

a. PURPOSE AND DATA USES — The primary purpose of the Near Midair Collision (NMAC) Reporting Program is to provide information for use in enhancing the safety and efficiency of the National Airspace System. Data obtained from NMAC reports are used by the FAA to improve the quality of FAA services to users and to develop programs, policies, and procedures aimed at the reduction of NMAC occurrences. All NMAC reports are thoroughly investigated by Flight Standards Facilities in coordination with Air Traffic Facilities. Data from these investigations are transmitted to FAA Headquarters in Washington, D.C. where they are compiled and analyzed, and where safety programs and recommendations are developed.

b. DEFINITION — A near midair collision is defined as an incident associated with the operation of an aircraft in which a possibility of collision occurs as a result of proximity of less than 500 feet to another aircraft, or a report is received from a pilot or a flight crew member stating that a collision hazard existed between two or more aircraft.

c. REPORTING RESPONSIBILITY — It is the responsibility of the pilot and/or flight crew to determine whether a near midair collision did actually occur and, if so, to initiate a NMAC report. Be specific, as ATC will not interpret a casual remark to mean that a NMAC is being reported.

d. WHERE TO FILE REPORTS — Pilots and/or flight crew members involved in NMAC occurrences are urged to report each incident immediately:

(1) By radio or telephone to the nearest FAA ATC facility or FSS.

(2) In writing, in lieu of the above, to the nearest Air Carrier District Office (ACDO), General Aviation District Office (GADO), or Flight Standards District Office (FSDO).

e. ITEMS TO BE REPORTED —

(1) Date and Time (UTC) of incident.

(2) Location of incident and altitude.

(3) Identification and type of reporting aircraft, aircrew destination, name and home base of pilot.

(4) Identification and type of other aircraft, aircrew destination, name and home base of pilot.

(5) Type of flight plans; station altimeter setting used.

(6) Detailed weather conditions at altitude or flight level.

(7) Approximate courses of both aircraft: indicate if one or both aircraft were climbing or descending.

(8) Reported separation in distance at first sighting, proximity at closest point horizontally and vertically, length of time in sight prior to evasive action.

(9) Degree of evasive action taken, if any (from both aircraft, if possible).

(10) Injuries, if any.

f. INVESTIGATION — The district office responsible for the investigation and reporting of NMAC's will be:

(1) The Air Carrier or Flight Standards District Office in whose area the incident occurred when an air carrier aircraft is involved.

(2) The General Aviation or Flight Standards District Office in whose area the incident occurred in all other cases.

Existing radar, communication, and weather data will be examined in the conduct of the investigation. When possible, all cockpit crew members will be interviewed regarding factors involving the NMAC incident. Air Traffic controllers will be interviewed in cases where one or more of the involved aircraft was provided ATC service. Both flight and ATC procedures will be evaluated. When the investigation reveals a violation of an FAA regulation, enforcement action will be pursued.

583—599. RESERVED

Chapter 7. MEDICAL FACTS FOR PILOTS

Section 1. FITNESS FOR FLIGHT

600. FITNESS FOR FLIGHT

a. Medical Certification

(1) All pilots except those flying gliders and free air ballons must possess valid medical certificates in order to exercise the privileges of their airman certificates. The periodic medical examinations required for medical certification are conducted by designated Aviation Medical Examiners, who are physicians with a special interest in aviation safety and training in aviation medicine.

(2) The standards for medical certification are contained in FAR—67. Pilots who have a history of certain medical conditions described in these standards are mandatorily disqualified from flying. These medical conditions include a personality disorder manifested by overt acts, a psychosis, alcoholism, drug dependence, epilepsy, an unexplained disturbance of consciousness, myocardial infarction, angina pectoris and diabetes requiring medication for its control. Other medical conditions may be temporarily disqualifying, such as acute infections, anemia, and peptic ulcer. Pilots who do not meet medical standards may still be qualified under special issuance provisions or the exemption process. This may require that either additional medical information be provided or practical flight tests be conducted.

(3) Student pilots should visit an Aviation Medical Examiner as soon as possible in their flight training in order to avoid unnecessary training expenses should they not meet the medical standards. For the same reason, the student pilot who plans to enter commercial aviation should apply for the highest class of medical certificate that might be necessary in the pilot's career.

> *Caution:* The FARs prohibit a pilot who possesses a current medical certificate from performing crewmember duties while the pilot has a known medical condition or increase of a known medical condition that would make the pilot unable to meet the standards for the medical certificate.

b. Illness

(1) Even a minor illness suffered in day-to-day living can seriously degrade performance of many piloting tasks vital to safe flight. Illness can produce fever and distracting symptoms that can impair judgment, memory, alertness, and the ability to make calculations. Although symptoms from an illness may be under adequate control with a medication, the medication itself may decrease pilot performance.

(2) The safest rule is not to fly while suffering from any illness. If this rule is considered too stringent for a particular illness, the pilot should contact an Aviation Medical Examiner for advice.

c. Medication

(1) Pilot performance can be seriously degraded by both prescribed and over-the-counter medications, as well as by the medical conditions for which they are taken. Many medications, such as tranquilizers, sedatives, strong pain relievers, and cough-suppressant preparations, have primary effects that may impair judgment, memory, alertness, coordination, vision, and the ability to make calculations. Others, such as antihistamines, blood pressure drugs, muscle relaxants, and agents to control diarrhea and motion sickness, have side effects that may impair the same critical functions. Any medication that depresses the nervous system, such as a sedative, tranquilizer or antihistamine, can make a pilot much more susceptible to hypoxia.

(2) The FARs prohibit pilots from performing crewmember duties while using any medication that affects the faculties in any way contrary to safety. The safest rule is not to fly as a crewmember while taking any medication, unless approved to do so by the FAA.

d. Alcohol

(1) Extensive research has provided a number of facts about the hazards of alcohol consumption and flying. As little as one ounce of liquor, one bottle of beer or four ounces of wine can impair flying skills, with the alcohol consumed in these drinks being detectable in the breath and blood for at least 3 hours. Even after the body completely destroys a moderate amount of alcohol, a pilot can still be severely impaired for many hours by hangover. There is simply no way of increasing the destruction of alcohol or alleviating a hangover. Alcohol also renders a pilot much more susceptible to disorientation and hypoxia.

(2) A consistently high alcohol related fatal aircraft accident rate serves to emphasize that alcohol and flying are a potentially lethal combination. The FARs prohibit pilots from performing crewmember duties within 8 hours after drinking any alcoholic beverage or while under the influence of alcohol. However, due to the slow destruction of alcohol, a pilot may still be under influence 8 hours after drinking a moderate amount of alcohol. Therefore, an excellent rule is to allow at least 12 to 24 hours between "bottle and throttle," depending on the amount of alcoholic beverage consumed.

e. Fatigue

(1) Fatigue continues to be one of the most treacherous hazards to flight safety, as it may not be apparent to a pilot until serious errors are made. Fatigue is best described as either acute (short-term) or chronic (long-term).

(2) A normal occurrence of everyday living, acute fatigue is the tiredness felt after long periods of physical and mental strain, including strenuous muscular effort, immobility, heavy mental workload, strong emotional pressure, monotony and lack of sleep. Consequently, coordination and alertness, so vital to safe pilot performance, can be reduced. Acute fatigue is prevented by adequate rest and sleep, as well as regular exercise and proper nutrition.

(3) Chronic fatigue occurs when there is not enough time for full recovery between episodes of acute fatigue. Performance continues to fall off, and judgment becomes impaired so that unwarranted risks may be taken. Recovery from chronic fatigue requires a prolonged period of rest.

f. Stress

(1) Stress from the pressures of everyday living can impair pilot performance, often in very subtle ways. Difficulties, particularly at work, can occupy thought processes enough to markedly decrease alertness. Distraction can so interfere with judgment that unwarranted risks are taken, such as flying into deteriorating weather conditions to keep on schedule. Stress and fatigue (see above) can be an extremely hazardous combination.

(2) Most pilots do not leave stress "on the ground." Therefore, when more than usual difficulties are being experienced, a pilot should consider delaying flight until these difficulties are satisfactorily resolved.

g. Emotion

(1) Certain emotionally upsetting events, including a serious argument, death of a family member, separation or divorce, loss of job and financial catastrophe, can render a pilot unable to fly an aircraft safely. The emotions of anger, depression, and anxiety from such events not only decrease alertness but also may lead to taking risks that border on self-destruction. Any pilot who experiences an emotionally upsetting event should not fly until satisfactorily recovered from it.

h. Personal Checklist

(1) Aircraft accident statistics show that pilots should be conducting preflight checklists on themselves as well as their aircraft, for pilot impairment contributes to many more accidents than failures of aircraft systems. A personal checklist that can be easily committed to memory, which includes all of the categories of pilot impairment as discussed in this section, is being distributed by the FAA in the form of a wallet-sized card.

PERSONAL CHECKLIST

I'm physically and mentally safe to fly — not being impaired by:

I llness,
M edication,
S tress,
A lcohol,
F atigue,
E motion.

601. EFFECTS OF ALTITUDE

a. Hypoxia

(1) Hypoxia is a state of oxygen deficiency in the body sufficient to impair functions of the brain and other organs. Hypoxia from exposure to altitude is due only to the reduced barometric pressures encountered at altitude, for the concentration of oxygen in the atmosphere remains about 21 percent from the ground out to space.

(2) Although a deterioration in night vision occurs at a cabin pressure altitude as low as 5,000 feet, other significant effects of altitude hypoxia usually do not occur in the normal healthy pilot below 12,000 feet. From 12,000 to 15,000 feet of altitude, judgment, memory, alertness, coordination and ability to make calculations are impaired, and headache, drowsiness, dizziness and either a sense of well-being (euphoria) or belligerence occur. The effects appear following increasingly shorter periods of exposure to increasing altitude. In fact, pilot performance can seriously deteriorate within 15 minutes at 15,000 feet.

(3) At cabin pressure altitudes above 15,000 feet, the periphery of the visual field grays out to a point where only central vision remains (tunnel vision). A blue coloration (cyanosis) of the fingernails and lips develops. The ability to take corrective and protective action is lost in 20 to 30 minutes at 18,000 feet and 5 to 12 minutes at 20,000 feet, followed soon thereafter by unconsciousness.

(4) The altitude at which significant effects of hypoxia occur can be lowered by a number of factors. Carbon monoxide inhaled in smoking or from exhaust fumes, lowered hemoglobin (anemia), and certain medications can reduce the oxygen-carrying capacity of the blood to the degree that the amount of oxygen provided to body tissues will already be equivalent to the oxygen provided to the tissues when exposed to a cabin pressure altitude of several thousand feet. Small amounts of alcohol and low doses of certain drugs, such as antihistamines, tranquilizers, sedatives and analgesics can, through their depressant action, render the brain much more susceptible to hypoxia. Extreme heat and cold fever, and anxiety increase the body's demand for oxygen, and hence its susceptibility to hypoxia.

(5) The effects of hypoxia are usually quite difficult to recognize, especially when they occur gradually. Since symptoms of hypoxia do not vary in an individual, the ability to recognize hypoxia can be greatly improved by experiencing and witnessing the effects of hypoxia during an altitude chamber "flight." The FAA provides this opportunity through aviation physiology training, which is conducted at the FAA Civil Aeromedical Institute and at many military facilities across the United States. Pilots can apply for this training by contacting the Physiological Operations and Training Section, AAC-143, FAA Civil Aeromedical Institute, P.O. Box 25082, Oklahoma City, Oklahoma 73125.

(6) Hypoxia is prevented by heeding factors that reduce tolerance to altitude, by enriching the inspired air with oxygen from an appropriate oxygen system and by maintaining a comfortable, safe cabin pressure altitude. For optimum protection, pilots are encouraged to use supplemental oxygen above 10,000 feet during the day, and above 5,000 feet at night. The FARs require that the minimum flight crew be provided with and use supplemental oxygen after 30 minutes of exposure to cabin pressure altitudes between 12,500 and 14,000 feet, and immediately on exposure to cabin pressure altitudes above 14,000 feet. Every occupant of the aircraft must be provided with supplemental oxygen at cabin pressure altitudes above 15,000 feet.

b. Ear Block

(1) As the aircraft cabin pressure decreases during ascent, the expanding air in the middle ear pushes the eustachian tube open and, by escaping down it to the nasal passages, equalizes in pressure with the cabin pressure. But during descent, the pilot must periodically open the eustachian tube to equalize pressure. This can be accomplished by swallowing, yawning, tensing muscles in the throat or, if these do not work, by the combination of clos-

ing the mouth, pinching the nose closed and attempting to blow through the nostrils (Valsalva maneuver).

(2) Either an upper respiratory infection, such as a cold or sore throat, or a nasal allergic condition can produce enough congestion around the eustachian tube to make equalization difficult. Consequently, the difference in pressure between the middle ear and aircraft cabin can build up to a level that will hold the eustachian tube closed, making equalization difficult if not impossible. The problem is commonly referred to as an "ear block."

(3) An ear block produces severe ear pain and loss of hearing that can last from several hours to several days. Rupture of the ear drum can occur in flight or after landing. Fluid can accumulate in the middle ear and become infected.

(4) An ear block is prevented by not flying with an upper respiratory infection or nasal allergic condition. Adequate protection is usually not provided by decongestant sprays or drops to reduce congestion around the eustachian tubes. Oral decongestants have side effects that can significantly impair pilot performance.

(5) If an ear block does not clear shortly after landing, a physician should be consulted.

c. Sinus Block

(1) During ascent and descent, air pressure in the sinuses equalizes with the aircraft cabin pressure through small openings that connect the sinuses to the nasal passages. Either an upper respiratory infection, such as a cold or sinusitis, or a nasal allergic condition can produce enough congestion around an opening to slow equalization and, as the difference in pressure between the sinus and cabin mounts, eventually plug the opening. This "sinus block" occurs most frequently during descent.

(2) A sinus block can occur in the frontal sinuses, located above each eyebrow, or in the maxillary sinuses, located in each upper cheek. It will usually produce excruciating pain over the sinus area. A maxillary sinus block can also make the upper teeth ache. Bloody muscus may discharge from the nasal passages.

(3) A sinus block is prevented by not flying with an upper respiratory infection or nasal allergic condition. Adequate protection is usually not provided by decongestant sprays or drops to reduce congestion around the sinus openings. Oral decongestants have side effects that can impair pilot performance.

(4) If a sinus block does not clear shortly after landing, a physician should be consulted.

d. Decompression Sickness After Scuba Diving

(1) A pilot or passenger who intends to fly after scuba diving should allow the body sufficient time to rid itself of excess nitrogen absorbed during diving. If not, decompression sickness due to evolved gas can occur during exposure to low altitude and create a serious in-flight emergency.

(2) The recommended waiting time before flight to cabin pressure altitudes of 8,000 feet or less is at least 4 hours after diving which has not required controlled ascent (nondecompression diving), and at least 24 hours after diving which has required controlled ascent (decompression diving). The waiting time before flight to cabin pressure altitudes above 8,000 feet should be at least 24 hours after any scuba diving.

602. HYPERVENTILATION IN FLIGHT

a. Hyperventilation, or an abnormal increase in the volume of air breathed in and out of the lungs, can occur subconsciously when a stressful situation is encountered in flight. As hyperventilation "blows off" excessive carbon dioxide from the body, a pilot can experience symptoms of lightheadedness, suffocation, drowsiness, tingling in the extremities, and coolness—and react to them with even greater hyperventilation. Incapacitation can eventually result from incoordination, disorientation, and painful muscle spasms. Finally, unconsciousness can occur.

b. The symptoms of hyperventilation subside within a few minutes after the rate and depth of breathing are consciously brought back under control. The buildup of carbon dioxide in the body can be hastened by controlled breathing in and out of a paper bag held over the nose and mouth.

c. Early symptoms of hyperventilation and hypoxia are similar. Moreover, hyperventilation and hypoxia can occur at the same time. Therefore, if a pilot is using an oxygen system when symptoms are experienced, the oxygen regulator should immediately be set to deliver 100 percent oxygen, and then the system checked to assure that it has been functioning effectively before giving attention to rate and depth of breathing.

603. CARBON MONOXIDE POISONING IN FLIGHT

a. Carbon monoxide is a colorless, odorless and tasteless gas contained in exhaust fumes. When breathed even in minute quantities over a period of time, it can significantly reduce the ability of the blood to carry oxygen. Consequently, effects of hypoxia occur.

b. Most heaters in light aircraft work by air flowing over the manifold. Use of these heaters while exhaust fumes are escaping through manifold cracks and seals is responsible every year for several nonfatal and fatal aircraft accidents from carbon monoxide poisoning.

c. A pilot who detects the odor of exhaust or experiences symptoms of headache, drowsiness, or dizziness while using the heater should suspect carbon monoxide poisoning, and immediately shut off the heater and open air vents. If symptoms are severe, or continue after landing, medical treatment should be sought.

604. ILLUSIONS IN FLIGHT

a. Introduction

(1) Many different illusions can be experienced in flight. Some can lead to spatial disorientation. Others can lead to landing errors. Illusions rank among the most common factors cited as contributing to fatal aircraft accidents.

b. Illusions Leading to Spatial Disorientation

(1) Various complex motions and forces and certain visual scenes encountered in flight can create illusions of motion and position. Spatial disorientation from these illusions can be prevented only by visual reference to reliable, fixed points on the ground or to flight instruments.

(2) The leans — An abrupt correction of a banked attitude, which has been entered too slowly to stimulate the motion sensing system in the inner ear, can create the illusion of banking in the opposite direction. The disoriented pilot will roll the aircraft back into its original dangerous attitude or, if level flight is maintained, will feel compelled to lean in the perceived vertical plane until this illusion subsides.

(a) Coriolis illusion — An abrupt head movement in a prolonged constant-rate turn that has ceased stimulating the motion sensing system can create the illusion of rotation or movement in an entirely different axis. The disoriented pilot will maneuver the aircraft into a dangerous attitude in an attempt to stop rotation. This most overwhelming of all illusions in flight may be prevented by not making sudden, extreme head movements, particularly while making prolonged constant-rate turns under IFR conditions.

(b) Graveyard spin — A proper recovery from a spin that has ceased stimulating the motion sensing system can create the illusion of spinning in the opposite direction. The disoriented pilot will return the aircraft to its original spin.

(c) Graveyard spiral— An observed loss of altitude during a coordinated constant-rate turn that has ceased stimulating the motion sensing system can create the illusion of being in a descent with the wings level. The disoriented pilot will pull back on the controls, tightening the spiral and increasing the loss of altitude.

(d) Somatogravic illusion — A rapid acceleration during takeoff can create the illusion of being in a nose up attitude. The disoriented pilot will push the aircraft into a nose low, or dive attitude. A rapid deceleration by a quick reduction of the throttles can have the opposite effect, with the disoriented pilot pulling the aircraft into a nose up, or stall attitude.

(e) Inversion illusion — An abrupt change from climb to straight and level flight can create the illusion of tumbling backwards. The disoriented pilot will push the aircraft abruptly into a nose low attitude, possibly intensifying this illusion.

(f) Elevator illusion — An abrupt upward vertical acceleration, usually by an updraft, can create the illusion of being in a climb. The disoriented pilot will push the aircraft into a nose low attitude. An abrupt downward vertical acceleration, usually by a downdraft, has the opposite effect, with the disoriented pilot pulling the aircraft into a nose up attitude.

(g) False horizon — Sloping cloud formations, an obscured horizon, a dark scene spread with ground lights and stars, and certain geometric patterns of ground light can create illusions of not being aligned correctly wih the actual horizon. The disoriented pilot will place the aircraft in a dangerous attitude.

(h) Autokinesis — In the dark, a static light will appear to move about when stared at for many seconds. The disoriented pilot will lose control of the aircraft in attempting to align it with the light.

(3) Illusions Leading to Landing Errors

(a) Various surface features and atmospheric conditions encountered in landing can create illusions of incorrect height above and distance from the runway threshold. Landing errors from these illusions can be prevented by anticipating them during approaches, aerial visual inspection of unfamiliar airports before landing, using electronic glide slope or VASI systems when available, and maintaining optimum proficiency in landing procedures.

(b) Runway width illusion — a narrower-than-usual runway can create the illusion that the aircraft is at a higher altitude than it actually is. The pilot who does not recognize this illusion will fly a lower approach, with the risk of striking objects along the approach path or landing short. A wider-than-usual runway can have the opposite effect, with the risk of leveling out high and landing hard or overshooting the runway.

(c) Runway and terrain slopes illusion — An upsloping runway, upsloping terrain, or both, can create the illusion that the aircraft is at a higher altitude than it actually is. The pilot who does not recognize this illusion will fly a lower approach. A downsloping runway, downsloping approach terrain, or both, can have the opposite effect.

(d) Featureless terrain illusion — An absence of ground features, as when landing over water, darkened areas and terrain made featureless by snow, can create the illusion that the aircraft is at a higher altitude than it actually is. The pilot who does not recognize this illusion will fly a lower approach.

(e) Atmospheric illusions — Rain on the windscreen can create the illusion of greater height, and atmospheric haze the illusion of being at a greater distance from the runway. The pilot who does not recognize these illusions will fly a lower approach. Penetration of fog can create the illusion of pitching up. The pilot who does not recognize this illusion will steepen the approach, often quite abruptly.

(f) Ground lighting illusions — Lights along a straight path, such as a road, and even lights on moving trains can be mistaken for runway and approach lights. Bright runway and approach lighting systems, especially where few lights illuminate the surrounding terrain, may create the illusion of less distance to the runway. The pilot who does not recognize this illusion will fly a higher approach. Conversely, the pilot overflying terrain which has few lights to provide height cues may make a lower than normal approach.

605. VISION IN FLIGHT

a. Introduction

(1) Of the body senses, vision is the most important for safe flight. Major factors that determine how effectively vision can be used are the level of illumination and the technique of scanning the sky for other aircraft.

b. Vision Under Dim and Bright Illumination

(1) Under conditions of dim illumination, small print and colors on aeronautical charts and aircraft instruments become unreadable unless adequate cockpit lighting is available. Moreover, another aircraft must be much closer to be seen unless its navigation lights are on.

(2) In darkness, vision becomes more sensitive to light, a process called dark adaptation. Although exposure to total darkness for at least 30 minutes is required for complete dark adaptation, the pilot can achieve a moderate degree of dark adaptation within 20 minutes under dim red cockpit lighting. Since red light severely distorts colors, es-

pecially on aeronautical charts, and can cause serious difficulty in focusing the eyes on objects inside the aircraft, its use is advisable only where optimum outside night vision capability is necessary. Even so, white cockpit lighting must be available when needed for map and instrument reading, especially under IFR conditions. Dark adaptation is impaired by exposure to cabin pressure altitudes above 5,000 feet, carbon monoxide inhaled in smoking and from exhaust fumes, deficiency of Vitamin A in the diet, and by prolonged exposure to bright sunlight. Since any degree of dark adaptation is lost within a few seconds of viewing a bright light, the pilot should close one eye when using a light to preserve some degree of night vision.

(3) Excessive illumination, especially from light reflected off the canopy, surfaces inside the aircraft, clouds, water, snow, and desert terrain, can produce glare, with uncomfortable squinting, watering of the eyes, and even temporary blindness. Sunglasses for protection from glare should absorb at least 85 percent of visible light (15 percent transmittance) and all colors equally (neutral transmittance), with negligible image distortion from refractive and prismatic errors.

c. Scanning for Other Aircraft

(1) Scanning the sky for other aircraft is a key factor in collision avoidance. It should be used continuously by the pilot and copilot (or right seat passenger) to cover all areas of the sky visible from the cockpit. Although pilots must meet specific visual acuity requirements, the ability to read an eye chart does not ensure that one will be able to efficiently spot other aircraft. Pilots must develop an effective scanning technique which maximizes one's visual capabilities. The probability of spotting a potential collision threat obviously increases with the time spent looking outside the cockpit. Thus, one must use timesharing techniques to efficiently scan the surrounding airspace while monitoring instruments as well.

(2) While the eyes can observe an approximate 200 degree arc of the horizon at one glance, only a very small center area called the fovea, in the rear of the eye, has the ability to send clear, sharply focused messages to the brain. All other visual information that is not processed directly through the fovea will be of less detail. An aircraft at a distance of 7 miles which appears in sharp focus within the foveal center of vision would have to be as close as 7/10 of a mile in order to be recognized if it were outside of foveal vision. Because the eyes can focus only on this narrow viewing area, effective scanning is accomplished with a series of short, regularly spaced eye movements that bring successive areas of the sky into the central visual field. Each movement should not exceed 10 degrees, and each area should be observed for at least one second to enable detection. Although horizontal back-and-forth eye movements seem preferred by most pilots, each pilot should develop a scanning pattern that is most comfortable and then adhere to it to assure optimum scanning.

(3) Studies show that the time a pilot spends on visual tasks inside the cabin should represent no more that 1/4 to 1/3 of the scan time outside, or no more than 4 to 5 seconds on the instrument panel for every 16 seconds outside. Since the brain is already trained to process sight information that is presented from left to right, one may find it easier to start scanning over the left shoulder and proceed across the windshield to the right.

(4) Pilots should realize that their eyes may require several seconds to refocus when switching views between items in the cockpit and distant objects. The eyes will also tire more quickly when forced to adjust to distances immediately after close-up focus, as required for scanning the instrument panel. Eye fatigue can be reduced by looking from the instrument panel to the left wing past the wing tip to the center of the first scan quandrant when beginning the exterior scan. After having scanned from left to right, allow the eyes to return to the cabin along the right wing from its tip inward. Once back inside, one should automatically commence the panel scan.

(5) Effective scanning also helps avoid "empty-field myopia." This condition usually occurs when flying above the clouds or in a haze layer that provides nothing specific to focus on outside the aircraft. This causes the eyes to relax and seek a comfortable focal distance which may range from 10 to 30 feet. For the pilot, this means looking without seeing, which is dangerous.

606. AEROBATIC FLIGHT

a. Airmen planning to engage in aerobatics should be aware of the physiological stresses associated with accelerative forces during aerobatic maneuvers. Many prospective aerobatic trainees enthusiastically enter aerobatic instruction but find their first experiences with G forces to be unanticipated and very uncomfortable. To minimize or avoid potential adverse effects, the aerobatic instructor and trainee must have a basic understanding of the physiology of G force adaptation.

b. Forces experienced with a rapid push-over maneuver result in the blood and body organs being displaced toward the head. Depending on forces involved and individual tolerance, the airman may experience discomfort, headache, "red-out," and even unconsciousness.

c. Forces experienced with a rapid pull-up maneuver result in the blood and body organ displacement toward the lower part of the body away from the head. Since the brain requires continuous blood circulation for an adequate oxygen supply, there is a physiologic limit to the time the pilot can tolerate higher forces before losing consciousness. As the blood circulation to the brain decreases as a result of forces involved, the airman will experience "narrowing" of visual fields, "gray-out," "black-out," and unconsciousness. Even a brief loss of consciousness in a maneuver can lead to improper control movement causing structural failure of the aircraft or collision with another object or terrain.

d. In steep turns, the centrifugal forces tend to push the pilot into the seat, thereby resulting in blood and body organ displacement toward the lower part of the body as in the case of rapid pull-up maneuvers and with the same physiologic effects and symptoms.

e. Physiologically, humans progressively adapt to imposed strains and stress, and with practice, any maneuver will have decreasing effect. Tolerance to G forces is dependent on human physiology and the individual pilot. These factors include the skeletal anatomy, the cardiovascular architecture, the nervous system, the quality of the blood, the general physical state, and experience and recency of exposure. The airman should consult an Aviation Medical Examiner prior to aerobatic training and be aware that poor

physical condition can reduce tolerance to accelerative forces.

f. The above information provides the airman a brief summary of the physiologic effects of G forces. It does not address methods of "counteracting" these effects. There are numerous references on the subject of G forces during aerobatics available to the airman. Among these are "G Effects on the Pilot During Aerobatics," (FAA-AM-72-28), "G Incapacitation in Aerobatic Pilots: A Flight Hazard" (FAA-AM-82-13). These are available from the National Technical Information Service, Springfield, Virginia 22161. See also FAA Advisory Circular — 91-61, "A HAZARD IN AEROBATICS: EFFECTS OF G-FORCES ON PILOTS."

607. JUDGMENT ASPECTS OF COLLISION AVOIDANCE

a. Introduction

(1) The most important aspects of vision and the techniques to scan for other aircraft are described in Paragraph 605 above. Pilots should also be familiar with the following information to reduce the possibility of mid-air collisions.

b. Determining Relative Altitude

(1) Use the horizon as a reference point. If the other aircraft is above the horizon, it is probably on a higher flight path. If the aircraft appears to be below the horizon, it is probably flying at a lower altitude.

c. Taking Appropriate Action

(1) Pilots should be familiar with rules on right-of-way, so if an aircraft is on an obvious collision course, one can take immediately evasive action, preferably in compliance with applicable Federal Aviation Regulations.

d. Consider Multiple Threats

(1) The decision to climb, descend, or turn is a matter of personal judgment, but one should anticipate that the other pilot may also be making a quick maneuver. Watch the other aircraft during the maneuver and begin your scanning again immediately since there may be other aircraft in the area.

e. Collision Course Targets

(1) Any aircraft that appears to have no relative motion and stays in one scan quadrant is likely to be on a collision course. Also, if a target shows no lateral or vertical motion, but increases in size, *take evasive action.*

f. Recognize High Hazard Areas

(1) Airways and especially VORs and airport traffic areas are places where aircraft tend to cluster.

(2) Remember, most collisions occur during days when the weather is good. Being in a "radar environment" still requires vigilance to avoid collisions.

g. Cockpit Management

(1) Studying maps, checklists, and manuals before flight, with other proper preflight planning (e.g., noting necessary radio frequencies) and organizing cockpit materials, can reduce the amount of time required to look at these items during flight, permitting more scan time.

h. Windshield Conditions

(1) Dirty or bug-smeared windshields can greatly reduce the ability of pilots to see other aircraft. Keep a clean windshield.

i. Visibility Conditions

(1) Smoke, haze, dust, rain, and flying towards the sun can also greatly reduce the ability to detect targets.

j. Visual Obstructions in the Cockpit

(1) Pilots need to move their heads to see around blind spots caused by fixed aircraft structures, such as door posts, wings, etc. It will be necessary at times to maneuver the aircraft (e.g., lift a wing) to facilitate seeing.

(2) Pilots must insure curtains and other cockpit objects (e.g., maps on glare shield) are removed and stowed during flight.

k. Lights On

(1) Day or night, use of exterior lights can greatly increase the conspicuity of any aircraft.

(2) Keep interior lights low at night.

l. ATC support

(1) ATC facilities often provide radar traffic advisories on a workload-permitting basis. Flight through the new Airport Radar Service Areas (ARSAs) requires communication with ATC. Use this support whenever possible or when required.

608—619. RESERVED

Chapter 8. AERONAUTICAL CHARTS AND RELATED PUBLICATIONS

Section 1. TYPES OF CHARTS AVAILABLE

620. GENERAL

Aeronautical charts for the U.S. and its territories and possessions are produced by the National Ocean Service (NOS), a part of the Department of Commerce, from information furnished by the FAA.

621. OBTAINING AERONAUTICAL CHARTS

En route Aeronautical Charts, En route Supplements, Approach Procedure Charts, Regional Airport/Facility Directories and other publications described in this Chapter are available upon subscription from the:

National Ocean Service
NOAA Distribution Branch (N/CG33)
Riverdale, Maryland 20737

622. TYPES OF CHARTS AVAILABLE

Sectional and VFR Terminal Area Charts
World Aeronautical Charts (U.S.)
En route Low Altitude Charts
En route High Altitude Charts
Alaska En route Charts (Low and High)
Aircraft Position Charts
Planning Charts
Instrument Approach Procedure Charts
Standard Instrument Departure (SID) Charts
Standard Terminal Arrival (STAR) Charts
Alaska Terminal Publication

623. GENERAL DESCRIPTION OF EACH CHART SERIES

a. Sectional and VFR Terminal Area Charts

(1) These charts are designed for visual navigation of slow and medium speed aircraft. They are produced to the following scales:

Sectional Charts — 1:500,000 (1 in = 6.86 NM)

VFR Terminal Area Charts — 1:250,000 (1 in = 3.43 NM)

(2) Topographic information features the portrayal of relief and a judicious selection of visual check points for VFR flight (Terminal Area Charts include populated places, drainage, roads, railroads, and other distinctive landmarks). Aeronautical information includes visual and radio aids to navigation, aerodromes, controlled airspace, restricted areas, obstructions, and related data. The VFR Terminal Area Charts also depict the airspace designated as "terminal control area" which provides for the control or segregation of all aircraft within the terminal control area. The Puerto Rico-Virgin Islands Terminal Area Chart contains basically the same information as that shown on the Sectional and Terminal Area Chart. It includes the Gulf of Mexico and Caribbean Planning Chart on the reverse side (See PLANNING CHARTS). Charts are revised semiannually except for several Alaskan Sectionals and the Puerto Rico-Virgin Islands Terminal Area which are revised annually.

b. World Aeronautical Charts

(1) These charts are designed to provide a standard series of aeronautical charts, covering land areas of the world, at a size and scale convenient for navigation by moderate speed aircraft. They are produced at a scale of 1:1,000,000 (1 in = 13.7 NM). Topographic information includes cities and towns, principal roads, railroads, distinctive landmarks, drainage and relief. The latter is shown by spot elevations, contours, and gradient tints. Aeronautical information includes visual and radio aids to navigation, aerodromes, airways, restricted areas, obstructions and other pertinent data. These charts are revised annually except several Alaskan charts and the Mexican/Caribbean charts which are revised every 2 years.

c. En route Low Altitude Charts

(1) These charts are designed to provide aeronautical information for en route navigation under Instrument Flight Rules (IFR) in the low altitude stratum. The series also includes En route Area Charts which furnish terminal data at a large scale in congested areas, and is included with the subscription to the series. Information includes the portrayal of L/MF and VHF airways, limits of controlled airspace, position, identification and frequencies of radio aids, selected aerodromes, minimum en route and obstruction clearance altitudes, airway distances, reporting points, special use airspace areas, military training routes and related information. Charts are printed back to back. Charts are revised every 56 days effective with the date of airspace changes. An En route Change Notice may be issued as required on the midpoint 28-day cycle.

d. En route High Altitude Charts

(1) These charts are designed to provide aeronautical information for en route navigation under IFR in the high altitude stratum. Information includes the portrayal of jet routes, position, identification and frequencies of radio aids, selected aerodromes, distances, time zones, special use airspace areas and related information. Charts are revised every 56 days effective with the date of airspace changes. An En route Change Notice may be issued as required on the midpoint 28-day cycle.

e. Alaska En route Charts (Low and High)

(1) These charts are produced in a low altitude and high altitude series with purpose and makeup identical to Low and High Altitude Charts described above. Charts are revised every 56 days effective with the date of airspace

changes. An En route Change Notice may be issued as required on the midpoint 28-day cycle.

f. Charted VFR Flyway Planning Chart

(1) These charts are designed to identify flight paths clear of the major controlled traffic flows. The program is intended to provide charts showing multiple VFR routings through high density traffic areas which may be used as an alternative to flight within TCAs. Ground references are provided as guides for improved visual navigation. These charts are not intended to discourage VFR operations within the TCAs, but are designed for information and planning purposes. They are produced at a scale of 1:250,000 (1 in = 3.43 NM). These charts are revised semi-annually and are published on the back of the existing VFR Terminal Area Charts.

g. Planning Charts

(1) ***VFR/IFR Planning Chart***

(a) These charts are designed to fulfill the requirements of preflight planning for flights under VFR/IFR. They are produced at a scale of 1:2,333,232 (1 in = 32 NM). The chart is printed in two parts in such a manner that, when assembled, it forms a composite VFR Planning Chart on one side and IFR Planning Chart on the other. Information on the IFR chart includes low altitude airways and mileages, navigational facilities, special use airspace areas, time zones, airports, isogonic lines, and related data. Information on the VFR chart includes selected populated places, large bodies of water, major drainage, shaded relief, navigational facilities, airports, special use airspace areas, military training routes and related data.

(2) ***Flight Case Planning Chart***

(a) This chart is designed for preflight and en route flight planning for VFR flights. It is produced at a scale of 1:4,374,803 (1 in = 60 NM). This chart contains basically the same information as the VFR/IFR Planning Chart with the addition of selected FSS and Weather Service Offices located at airport sites, parachute jumping areas, a tabulation of special use airspace areas, a mileage table listing distances between 174 major airports and a city/aerodrome location index.

(3) ***Gulf of Mexico and Caribbean Planning Chart***

(a) This chart is designated for preflight planning for VFR flights. It is produced at a scale of 1:6,270,551 (1 in = 86 NM). This chart is on the reverse of the Puerto Rico-Virgin Islands Terminal Area Chart. Information includes mileage between Airports of Entry, a selection of special use airspace areas and a Directory of Aerodromes with their available facilities and servicing.

(4) ***Instrument Approach Procedure (IAP) Charts***

(a) IAP charts portray the aeronautical data which is required to execute instrument approaches to airports. These charts are published in 15 bound volumes covering the conterminous U.S. and the Puerto Rico-Virgin Islands. Each new volume is superseded by a new volume each 56 days. Changes to procedures occurring between the 56 day publication cycle is reflected in a change notice volume issued on the 28 day midcycle. These changes are in the form of a new chart. The publication of a new 56 day volume incorporates all the changes and replaces the preceding volume and the change notice. The bound volumes are 5 3/8 x 8 1/4 inches and bound on the top edge. Each chart contained depicts the IAP, all related navigation data, communications information and an airport diagram. Each procedure is designated for use with a specific electronic navigational aid, such as ILS, VOR, NDB, RNAV, etc. Airport Taxi Charts where published, are included.

(5) ***Standard Instrument Departure (SID) Charts***

(a) These charts are designed to expedite clearance delivery and to facilitate transition between takeoff and en route operations. They are published in a bound book, 5 3/8 inches by 8 1/4 inches, and furnish pilots departure routing clearance information in graphic and textual form. These are two bound volumes which are issued every 56 days.

(6) ***Standard Terminal Arrival (STAR) Charts***

(a) These charts are designed to expedite ATC arrival route procedures and to facilitate transition between en route and instrument approach operations. These charts, published in a bound book, 5 3/8 inches by 8 1/4 inches, present to the pilot preplanned IFR ATC arrival route procedures in graphic and textual form. Each STAR procedure is presented as a separate chart and may serve a single airport or more than one airport in a given geographic location. One bound volume of STAR charts for the U.S., excluding Alaska, is issued every 56 days.

(7) ***Alaska Terminal Publication***

(a) This publication contains charts depicting all terminal flight procedures in the State of Alaska for civil and military aviation. They are:

Instrument Approach Procedure (IAP) Charts.
Standard Instrument Departure (SID) Charts.
Standard Terminal Arrival (STAR) Charts.
Airport Taxi Charts.
Radar Minimums.

(b) All supplementary supporting data, i.e.: IFR Takeoff and Departure Procedures, IFR Alternate Minimums, Rate of Descent Table, Inoperative Components Table, etc., is also included.

(c) The Alaska Terminal is published in a bound book 5 3/8 inches by 8 1/4 inches, and is arranged alphabetically by airport name with all procedures appropriate to the airport following the airport name: STAR, IAP, TAXI, SID. The publication is issued every 56 days with provisions for an as required "Terminal Change" on the 28 day midpoint.

624. RELATED PUBLICATIONS

a. The Airport Facility Directory

(1) This directory is issued in seven volumes with each volume covering a specific geographic area of the conterminous U.S., including Puerto Rico and the U.S. Virgin Islands. The directory is 5 3/8 X 8 1/4 inches and is bound on the side. Each volume is reissued in its entirety each 56 days. Each volume is indexed alphabetically by state, airport, navigational aid, and ATC facility for the area of coverage. All pertinent information concerning each entry is included.

b. Alaska Supplement

(1) This supplement is a joint Civil and Military Flight Information Publication (FLIP), published and distributed every 56 days by the NOS. It is designed for use with the Flight Information Publication En route Charts.

Alaska Terminal, WAC and Sectional Aeronautical Charts. This Supplement contains an Airport/Facility Directory of all airports shown on En route Charts, and those requested by appropriate agencies, communications data, navigational facilities, special notices and procedures applicable to the area of chart coverage.

c. Pacific Supplement

(1) This Chart Supplement is a Civil Flight Information Publication, published and distributed every 56 days by the NOS. It is designed for use with the Flight Information En route Publication Charts and the Sectional Aeronautical Chart covering the State of Hawaii and that area of the Pacific served by U.S. facilities. An Amendment Notice is published 4 weeks after each issue of the Supplement. This chart Supplement contains an Airport/Facility Directory of all airports open to the public, and those requested by appropriate agencies, communications data, navigational facilities, special notices and procedures applicable to the Pacific area.

d. Defense Mapping Agency Aerospace Center (DMAAC) Publications

(1) **Pilotage Charts (PC/TPC)** — Scale 1:500,000 used for detail preflight planning and mission analysis. Emphasis in design is on ground features significant in visual and radar, low-level high speed navigation.

(2) **Jet Navigation Charts (JNC-A)** — Scale 1:3,000,000. Designed to provide greater coverage than the 1:2,000,000 scale Jet Navigation Charts described below. Uses include preflight planning and en route navigation by long-range jet aircraft with dead reckoning, radar, celestial and grid navigation capabilities.

(3) **LORAN Navigation & Consol LORAN Navigation Charts (LJC/CJC)** — Scale 1:2,000,000. Used for preflight planning and in-flight navigation on long-range flights in the Polar areas and adjacent regions utilizing LORAN and Consol navigation aids.

(4) **Continental Entry Chart (CEC)** — Scale 1:2,000,000. Used for CONSOLAN and LORAN navigation for entry into the U.S. when a high degree of accuracy is required to comply with Air Defense identification and reporting procedures. Also suitable as a basic dead reckoning sheet and for celestial navigation.

(5) **Aerospace Planning Chart (ASC)** — Scale 1:9,000,000 and 1:18,000,000. Six charts at each scale and with various projections, cover the world. Charts are useful for general planning, briefings, and studies.

(6) **Air Distance/Geography Chart (GH-2, 2a)** — Scales 1:25,000,000 and 1:50,000,000. This chart shows great circle distances between major airports. It also shows major cities, international boundaries, shaded relief and gradient tints.

(7) **LORAN C Navigation Chart (LCC)** — Scale 1:3,000,000. Primarily designed for preflight and in-flight long-range navigation where LORAN C is used as the basic navigation aid.

(8) **DOD Weather Plotting Chart (WPC)** — Various scales. Designed as nonnavigational outline charts which depict locations and identifications of meterological observing stations. Primarily used to forecast and monitor weather and atmospheric conditions throughout the world.

(9) **Flight Information Publications (FLIP)** — These include En route Low Altitude and High Altitude Charts, En route Supplements, Terminal (Instrument Approach Charts), and other informational publications for various areas of the world.

NOTE.— FLIP. Terminal publications do not necessarily include all instrument approach procedures for all airports. They include only those required for military operations. More complete information and price may be obtained from National Ocean Service, Distribution Branch.

(10) **World Aeronautical (WAC) and Operational Navigation Charts (ONC)** — The Operational Navigation Charts (ONC) have the same purpose and contain essentially the same information as the WAC series except the terrain is portrayed by shaded relief as well as contours. The ONC series is replacing the WAC series and the WAC's will be available only where the ONC's have not been issued. ONC's are 42 X 57 1/2 inches, WAC's are 22 X 30 inches. These charts are revised on a regular schedule.

(11) **Jet Navigation Charts** — These charts are designed to fulfill the requirements for long-range high altitude, high speed navigation. They are produced at a scale of 1:2,000,000 (1 in=27.4 NM). Topographic features include large cities, roads, railroads, drainage and relief. The latter is indicated by contours, spot elevations and gradient tints. All aeronautical information necessary to conform to the purpose of the chart is shown. This includes restricted areas, L/MF and VOR ranges, radio beacons and a selection of standard broadcasting stations and aerodromes. The runway patterns of the aerodromes are shown to exaggerated scale in order that they may be readily identified as visual landmarks. Universal Jet Navigation Charts are used as plotting charts in the training and practice of celestial and dead reckoning navigation. They may also be used for grid navigational training.

(12) **Global Navigational Charts** — These charts are designed to fulfill the requirements for aeronautical planning, operations over long distances, and en route navigation in long-range, high altitude, high speed aircraft. They are produced at a scale of 1:5,000,000 (1 in=68.58 NM). Global Navigation Charts (GNC) are 42 by 57 1/2 inches. They show principal cities, towns and drainage, primary roads and railroads, prominent culture and shadient relief augmented with tints and spot elevations. Aeronautical data includes radio aids to navigation, aerodrome and restricted areas. Charts 1 and 26 have a polar navigation grid and charts 2 and 6 have sub-polar navigation grids. Global LORAN Navigation Charts (GLC) are the same size and scale and cover the same area as the GNC charts. They contain major cities only, coast lines, major lakes and rivers, and land tint. No relief or vegetation. Aeronautical data includes radio aids to navigation and LORAN lines of position.

625. AUXILIARY CHARTS

a. Airport Obstruction Charts (OC):

(1) These large scale (1:12,000) charts of airports show runways and flight paths for landing and takeoff, together with the positions and elevations of the objects which are potential hazards to these operations. The charts are used in determining the maximum safe takeoff and landing gross weight of civil aircraft, in determining airport instrument approach and landing procedures, and to provide data for engineering plans relative to clearing of obstructions and improvement of airport facilities.

b. Military Training Routes:

(1) Charts and Booklet: The Defense Mapping Agency Aerospace Center (DMAAC) publishes a narrative description in booklet form and charts depicting the IFR and VFR Training Routes.

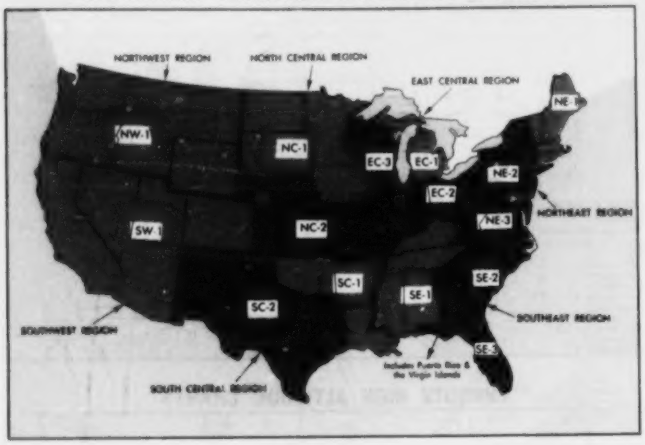
(2) The charts and booklet are published every 56 days. Both the charts and narrative route description booklet are available to the general public as a brochure by single copy or annual subscription.

(3) Subscription and single-copy requests should be for the "DOD Area Planning AP/1B, Military Training Routes".

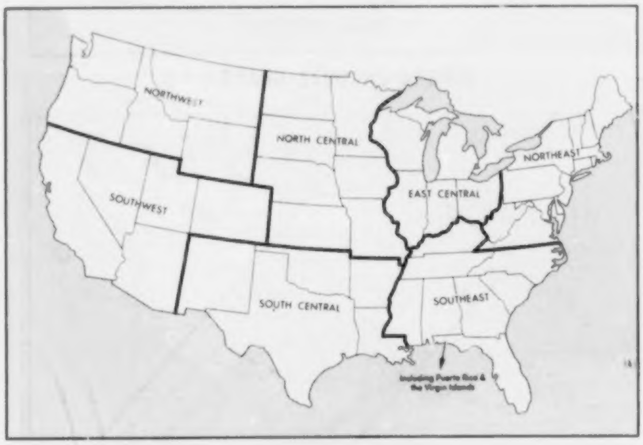
NOTE.— The DOD provides these booklets and charts to each FSS for use in preflight pilot briefings. Pilots should review this information to acquaint themselves with those routes that are located along their route of flight and in the vicinity of the airports from which they operate.

626—999. RESERVED

INSTRUMENT APPROACH PROCEDURE CHARTS

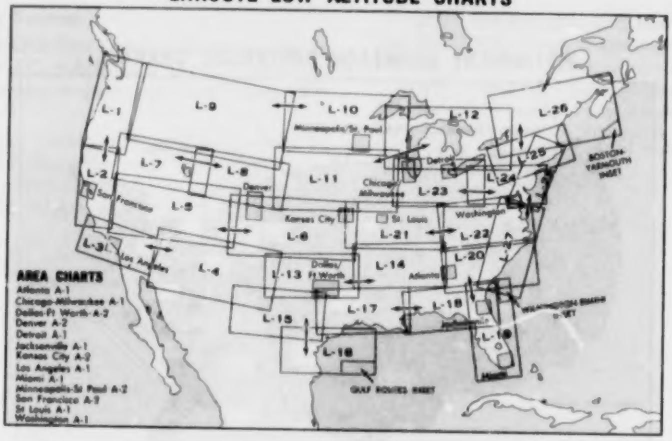

NORTHWEST REGION
NORTH CENTRAL REGION
EAST CENTRAL REGION
NE-1
NW-1
NC-1
EC-3
EC-1
NE-2
EC-2
NORTHEAST REGION
SW-1
NC-2
NE-3
SC-1
SE-1
SE-2
SC-2
SOUTHEAST REGION
SOUTHWEST REGION
SE-3
Includes Puerto Rico & the Virgin Islands
SOUTH CENTRAL REGION

AIRPORT/FACILITY DIRECTORY

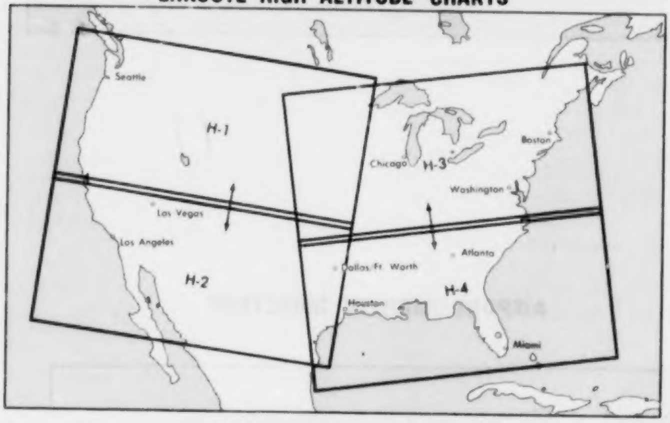

NORTHWEST
NORTH CENTRAL
NORTHEAST
EAST CENTRAL
SOUTHWEST
SOUTH CENTRAL
SOUTHEAST
Including Puerto Rico & the Virgin Islands

TYPES OF CHARTS AVAILABLE

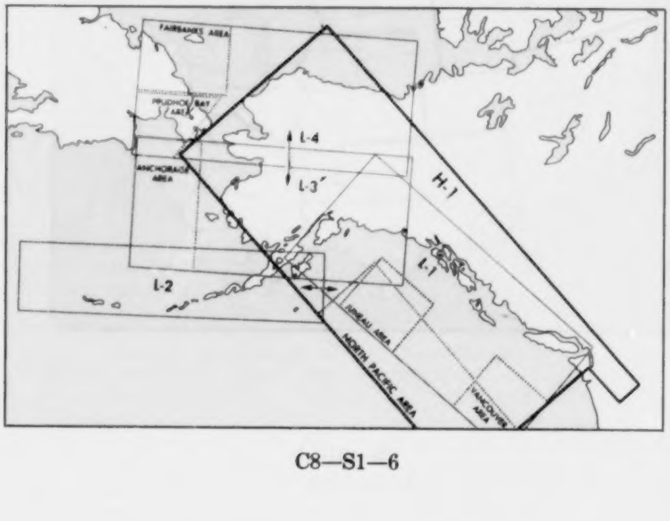
ENROUTE LOW ALTITUDE CHARTS


L-1
L-9
L-10
Minneapolis/St Paul
L-12
L-26
L-25
BOSTON-YARMOUTH INSET
L-7
L-8
L-2
Denver
L-11
Chicago/Milwaukee
Detroit
L-23
L-24
San Francisco
L-5
Kansas City
St Louis
Washington
L-6
L-21
L-22
L-3
Los Angeles
L-4
Dallas/Ft Worth
L-13
L-14
Atlanta
L-20
L-17
L-18
WASHINGTON-BIMINI INSET
L-15
L-16
L-19
Miami
GULF ROUTES INSET
AREA CHARTS
Atlanta A-1
Chicago-Milwaukee A-1
Dallas-Ft Worth A-2
Denver A-2
Detroit A-1
Jacksonville A-1
Kansas City A-2
Los Angeles A-1
Miami A-1
Minneapolis-St Paul A-2
San Francisco A-2
St Louis A-1
Washington A-1

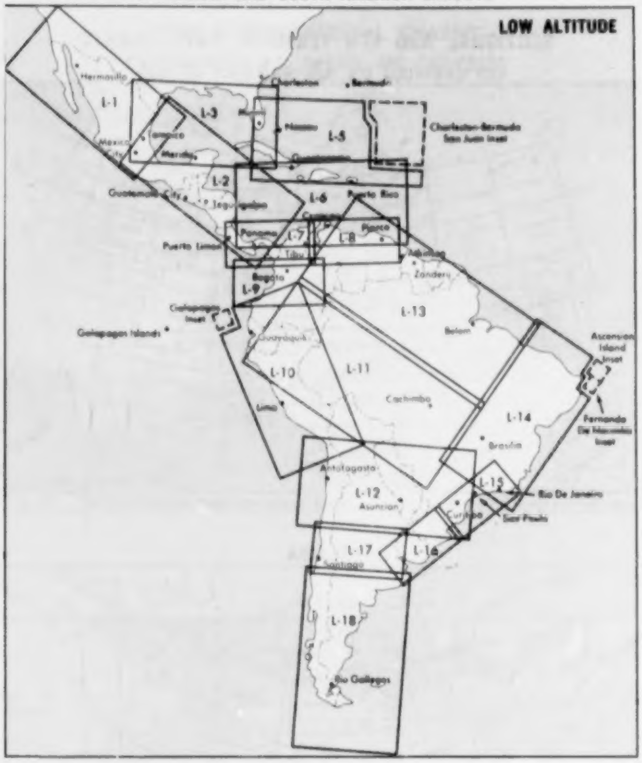
ENROUTE HIGH ALTITUDE CHARTS


Seattle
H-1
Chicago
H-3
Boston
Washington
Las Vegas
Los Angeles
Atlanta
Dallas/Ft Worth
H-2
H-4
Houston
Miami

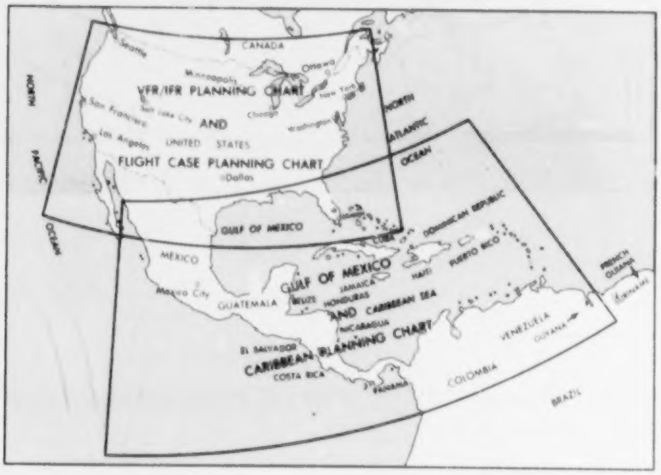
ALASKA ENROUTE CHARTS


FAIRBANKS AREA
PRUDHOE BAY AREA
L-4
ANCHORAGE AREA
L-3
H-1
L-1
L-2
JUNEAU AREA
NORTH PACIFIC AREA
VANCOUVER AREA

FLIGHT INFORMATION PUBLICATIONS
CARIBBEAN AND SOUTH AMERICA ENROUTE

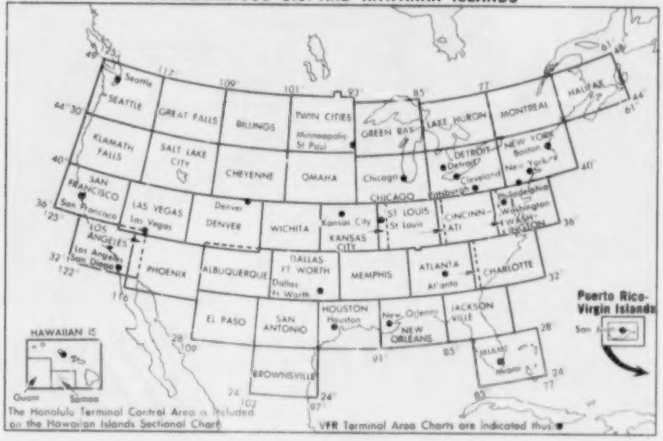

LOW ALTITUDE
Hermosillo
L-1
L-3
Charleston
Bermuda
Nassau
L-5
Charleston-Bermuda
San Juan Inset
Tampico
Mexico City
Merida
L-2
Guatemala City
Tegucigalpa
L-6
Puerto Rico
Panama
L-7
L-8
Piarco
Puerto Limon
Tibu
Zandery
Bogota
L-9
Galapagos Inset
Galapagos Islands
L-13
Belem
Ascension Island Inset
Guayaquil
L-10
L-11
Lima
Cachimbo
L-14
Fernando De Noronha Inset
Brasilia
Antofagasta
L-15
Rio De Janeiro
L-12
Asuncion
Curitiba
Sao Paulo
L-17
L-16
Santiago
L-18
Rio Gallegos

PLANNING CHARTS


CANADA
Seattle
Minneapolis
Ottawa
VFR/IFR PLANNING CHART
New York
San Francisco
Salt Lake City
AND
Chicago
Washington
NORTH
ATLANTIC
OCEAN
Los Angeles
UNITED STATES
NORTH
PACIFIC
OCEAN
FLIGHT CASE PLANNING CHART
Dallas
GULF OF MEXICO
CUBA
DOMINICAN REPUBLIC
MEXICO
GULF OF MEXICO
JAMAICA
HAITI
PUERTO RICO
FRENCH GUIANA
Mexico City
GUATEMALA
BELIZE
HONDURAS
AND CARIBBEAN SEA
NICARAGUA
VENEZUELA
GUYANA
EL SALVADOR
CARIBBEAN PLANNING CHART
COSTA RICA
PANAMA
COLOMBIA
BRAZIL

SECTIONAL AND VFR TERMINAL AREA CHARTS

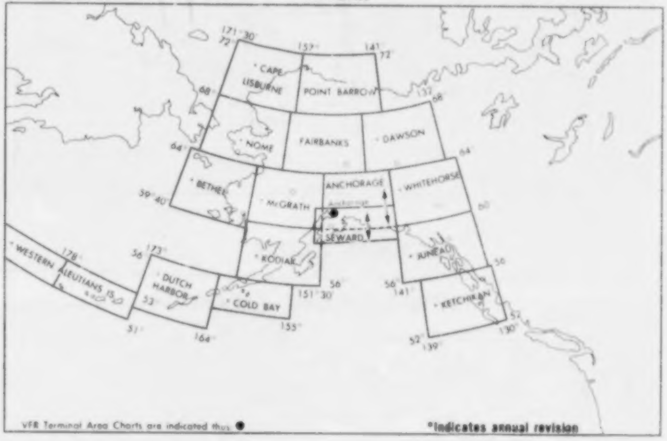
CONTERMINOUS U.S. AND HAWAIIAN ISLANDS


SEATTLE
Seattle
GREAT FALLS
BILLINGS
TWIN CITIES
Minneapolis St Paul
GREEN BAY
LAKE HURON
MONTREAL
HALIFAX
KLAMATH FALLS
SALT LAKE CITY
CHEYENNE
OMAHA
Chicago
CHICAGO
DETROIT
Detroit
Cleveland
Pittsburgh
NEW YORK
Boston
New York
Philadelphia
Washington
WASHINGTON
SAN FRANCISCO
San Francisco
LAS VEGAS
Las Vegas
Denver
DENVER
WICHITA
Kansas City
KANSAS CITY
ST LOUIS
St Louis
CINCINNATI
LOS ANGELES
Los Angeles
San Diego
PHOENIX
ALBUQUERQUE
DALLAS FT WORTH
Dallas Ft Worth
MEMPHIS
ATLANTA
Atlanta
CHARLOTTE
EL PASO
SAN ANTONIO
HOUSTON
Houston
New Orleans
NEW ORLEANS
JACKSONVILLE
MIAMI
Miami
BROWNSVILLE
HAWAIIAN IS
Guam
Samoa
Puerto Rico-Virgin Islands
San Juan
49°
125°
117°
109°
101°
93°
85°
77°
61°
48°
44°
44°30'
40°
36°
125°
32°
122°
116
28°
109
24
103
24°
97°
91°
85°
83
77
32°
28°
24

The Honolulu Terminal Control Area is included on the Hawaiian Islands Sectional Chart

VFR Terminal Area Charts are indicated thus ●

ALASKA

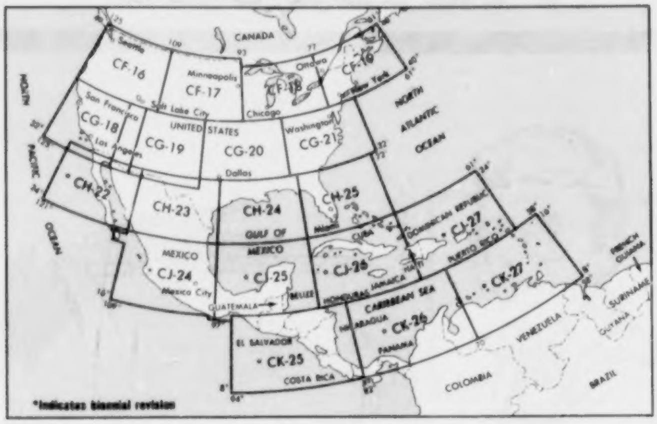

*CAPE LISBURNE
POINT BARROW
*NOME
FAIRBANKS
*DAWSON
*BETHEL
*McGRATH
ANCHORAGE
Anchorage
*WHITEHORSE
SEWARD
*WESTERN ALEUTIANS IS.
*DUTCH HARBOR
*KODIAK
*COLD BAY
*JUNEAU
*KETCHIKAN
171°30'
72°
157°
141°
72°
68°
137°
68°
64°
64°
59°40'
60°
178°
56
173°
53°
51°
164°
155°
56°
151°30'
56°
141°
56
52°
139°
52
130°

VFR Terminal Area Charts are indicated thus ●

*Indicates annual revision

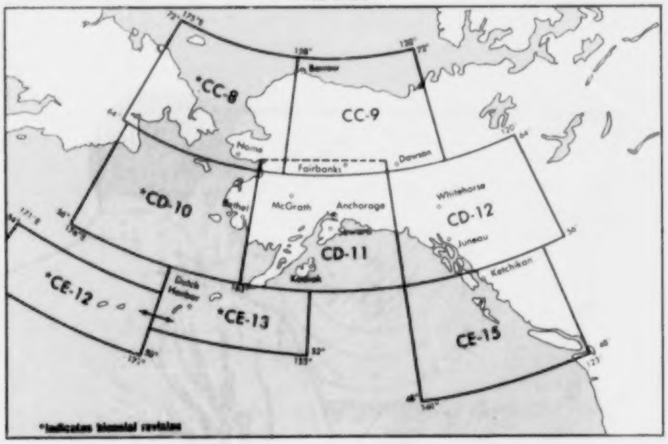
WORLD AERONAUTICAL CHARTS

CONTERMINOUS U.S., MEXICO, AND CARIBBEAN


CF-16
CF-17
CF-18
CF-19
CG-18
CG-19
CG-20
CG-21
*CH-22
CH-23
CH-24
CH-25
*CJ-24
*CJ-25
*CJ-26
*CJ-27
*CK-25
*CK-26
*CK-27
Seattle
Minneapolis
Salt Lake City
Chicago
Ottawa
New York
San Francisco
Los Angeles
UNITED STATES
Washington
Dallas
Miami
MEXICO
Mexico City
GUATEMALA
BELIZE
HONDURAS
EL SALVADOR
NICARAGUA
COSTA RICA
PANAMA
CUBA
JAMAICA
HAITI
DOMINICAN REPUBLIC
PUERTO RICO
CANADA
GULF OF MEXICO
CARIBBEAN SEA
NORTH ATLANTIC OCEAN
NORTH PACIFIC OCEAN
COLOMBIA
VENEZUELA
GUYANA
SURINAME
FRENCH GUIANA
BRAZIL
125
109
93
77
32
72
24
16
8°
84°

*Indicates biennial revision

ALASKA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*CD-10
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CD-12
*CE-12
*CE-13
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Barrow
Nome
Fairbanks
Dawson
Bethel
McGrath
Anchorage
Whitehorse
Seward
Juneau
Kodiak
Ketchikan
Dutch Harbor
72°
138°
120
64
56
48°
123
140°

*Indicates biennial revision

NOTES

PILOT/CONTROLLER GLOSSARY

U.S. Department of Transportation

Federal Aviation Administration

160-789 0 - 86 - 9

PILOT/CONTROLLER GLOSSARY

AUGUST 28,1986

This Glossary was compiled to promote a common understanding of the terms used in the Air Traffic Control system. It includes those terms which are intended for pilot/controller communications. Those terms most frequently used in pilot/controller communications are printed in ***bold italics***. The definitions are primarily defined in an operational sense applicable to both users and operators of the National Airspace System. Use of the Glossary will preclude any misunderstandings concerning the system's design, function, and purpose.

Because of the international nature of flying, terms used in the "Lexicon," published by the International Civil Aviation Organization (ICAO), are included when they differ from FAA definitions. These terms are *italicized*. For the reader's convenience, there are also cross references to related terms in other parts of the Glossary and to other documents, such as the Federal Aviation Regulations (FAR's) and the Airman's Information Manual (AIM).

This Glossary will be revised as necessary to maintain a common understanding of the system.

ABBREVIATED IFR FLIGHT PLANS— An authorization by ATC requiring pilots to submit only that information needed for the purpose of ATC. It includes only a small portion of the usual IFR flight plan information. In certain instances, this may be only aircraft identification, location, and pilot request. Other information may be requested if needed by ATC for separation/control purposes. It is frequently used by aircraft which are airborne and desire an instrument approach or by aircraft which are on the ground and desire a climb to VFR-on-top. (See VFR-ON-TOP) (Refer to AIM)

ABEAM— An aircraft is "abeam" a fix, point, or object when that fix, point, or object is approximately 90 degrees to the right or left of the aircraft track. Abeam indicates a general position rather than a precise point.

ABORT— To terminate a preplanned aircraft maneuver; e.g., an aborted takeoff.

ACKNOWLEDGE— Let me know that you have received my message.

ICAO—ACKNOWLEDGE— Let me know that you have received and understood this message.

ACROBATIC FLIGHT— An intentional maneuver involving an abrupt change in an aircraft's attitude, an abnormal attitude, or abnormal acceleration not necessary for normal flight. (Refer to FAR Part 91)

*ICAO—ACROBATIC FLIGHT—*Maneuvers intentionally performed by an aircraft involving an abrupt change in its attitude, an abnormal attitude, or an abnormal variation in speed.

ADDITIONAL SERVICES— Advisory information provided by ATC which includes but is not limited to the following:

1. Traffic advisories.
2. Vectors, when requested by the pilot, to assist aircraft receiving traffic advisories to avoid observed traffic.
3. Altitude deviation information of 300 feet or more from an assigned altitude as observed on a verified (reading correctly) automatic altitude readout (Mode C).
4. Advisories that traffic is no longer a factor.
5. Weather and chaff information.
6. Weather assistance.
7. Bird activity information.
8. Holding pattern surveillance.

Additional services are provided to the extent possible contingent only upon the controller's capability to fit them into the performance of higher priority duties and on the basis of limitations of the radar, volume of traffic, frequency congestion, and controller workload. The controller has complete discretion for determining if he is able to provide or continue to provide a service in a particular case. The controller's reason not to provide or continue to provide a service in a particular case is not subject to question by the pilot and need not be made known to him. (See Traffic Advisories) (Refer to AIM)

ADMINISTRATOR— The Federal Aviation Administrator or any person to whom he has delegated his authority in the matter concerned.

ADVISE INTENTIONS— Tell me what you plan to do.

ADVISORY— Advice and information provided to assist pilots in the safe conduct of flight and aircraft movement. (See Advisory Service)

ADVISORY FREQUENCY— The appropriate frequency to be used for Airport Advisory Service. (See Airport Advisory Service and UNICOM) (Refer to Advisory Circular No. 90-42 and AIM)

ADVISORY SERVICE— Advice and information provided by a facility to assist pilots in the safe conduct of flight and aircraft movement. (See Airport Advisory Service, Traffic Advisories, Safety Alerts, Additional Services, Radar Advisory, En Route Flight Advisory Service) (Refer to AIM)

AERIAL REFUELING/IN-FLIGHT REFUELING— A procedure used by the military to transfer fuel from one aircraft to another during flight. (Refer to VFR/IFR Wall Planning Charts).

AERODROME— A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure, and movement of aircraft.

AERONAUTICAL BEACON— A visual NAVAID displaying flashes of white and/or colored light to indicate the location of an airport, a heliport, a landmark, a certain point of a Federal airway in mountainous terrain, or an obstruction. (See Airport Rotating Beacon) (Refer to AIM)

AERONAUTICAL CHART— A map used in air navigation containing all or part of the following: Topographic features, hazards and obstructions, navigation aids, navigation routes, designated airspace, and airports. Commonly used aeronautical charts are:

1. Sectional Charts—1:500,000—Designed for visual navigation of slow or medium speed aircraft. Topographic information on these charts features the portrayal of relief and a judicious selection of visual check points for VFR flight. Aeronautical information includes visual and radio aids to navigation, airports, controlled airspace, restricted areas, obstructions, and related data.
2. VFR Terminal Area Charts—1:250,000—Depict Terminal Control Area (TCA) airspace which provides for the control or segregation of all the aircraft within the TCA. The chart depicts topographic information and aeronautical information which includes visual and radio aids to navigation, airports, controlled airspace, restricted areas, obstructions, and related data.
3. World Aeronautical Charts (WAC)—1:1,000,000—Provide a standard series of aeronautical charts covering land areas of the world at a size and scale convenient for navigation by moderate speed aircraft. Topographic information includes cities and towns, principal roads, railroads, distinctive landmarks, drainage, and relief. Aeronautical information includes visual and radio aids to navigation, airports, airways, restricted areas, obstructions, and other pertinent data.
4. En Route Low Altitude Charts—Provide aeronautical information for en route instrument navigation (IFR) in the low altitude stratum. Information includes the portrayal of airways, limits of controlled airspace, position identification and frequencies of radio aids, selected airports, minimum en route and minimum obstruction clearance altitudes, airway distances, reporting points, restricted areas, and related data. Area charts, which are a part of this series, furnish terminal data at a larger scale in congested areas.
5. En Route High Altitude Charts—Provide aeronautical information for en route instrument navigation (IFR) in the high altitude stratum. Information includes the portrayal of jet routes, identification and frequencies of radio aids, selected airports, distances, time zones, special use airspace, and related information.
6. Instrument Approach Procedures (IAP) Charts—Portray the aeronautical data which is required to execute an instrument approach to an airport. These charts depict the procedures, including all related data, and the airport diagram. Each procedure is designated for use with a specific type of electronic navigation system including NDB, TACAN, VOR, ILS/MLS, and RNAV. These charts are identified by the type of navigational aid(s) which provide final approach guidance.
7. Standard Instrument Departure (SID) Charts—Designed to expedite clearance delivery and to facilitate transition between takeoff and en route operations. Each SID procedure is presented as a separate chart and may serve a single airport or more than one airport in a given geographical location.
8. Standard Terminal Arrival (STAR) Charts— Designed to expedite air traffic control arrival procedures and to facilitate transition between en route and instrument approach operations. Each STAR procedure is presented as a separate chart and may serve a single airport or more than one airport in a given geographical location.
9. Airport Taxi Charts—Designed to expedite the efficient and safe flow of ground traffic at an airport. These charts are identified by the official airport name; e.g., Washington National Airport.

*ICAO—AERONAUTICAL CHART—*A representation of a portion of the earth, its culture and relief, specifically designated to meet the requirements of air navigation.

AFFIRMATIVE— Yes.

AIR CARRIER DISTRICT OFFICE/ACDO— An FAA field office serving an assigned geographical area, staffed with Flight Standards personnel serving the aviation industry and the general public on matters related to the certification and operation of scheduled air carriers and other large aircraft operations.

AIRCRAFT— Device/s that are used or intended to be used for flight in the air, and when used in air traffic control terminology, may include the flight crew.

ICAO-AIRCRAFT—Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface.

AIRCRAFT APPROACH CATEGORY— A grouping of aircraft based on a speed of 1.3 times the stall speed in the landing configuration at maximum gross landing weight. An aircraft shall fit in only one category. If it is necessary to maneuver at speeds in excess of the upper limit of a speed range for a category, the minimums for the next higher category should be used. For example, an aircraft which falls in Category A, but is circling to land at a speed in excess of 91 knots, should use the approach Category B minimums when circling to land. The categories are as follows:

1. Category A—Speed less than 91 knots.
2. Category B—Speed 91 knots or more but less than 121 knots.
3. Category C—Speed 121 knots or more but less than 141 knots.
4. Category D—Speed 141 knots or more but less than 166 knots.
5. Category E—Speed 166 knots or more.

(Refer to FAR Parts 1 and 97)

AIRCRAFT CLASSES— For the purposes of Wake Turbulence Separation Minima, ATC classifies aircraft as Heavy, Large, and Small as follows:

1. Heavy—Aircraft capable of takeoff weights of 300,000 pounds or more whether or not they are operating at this weight during a particular phase of flight.
2. Large—Aircraft of more than 12,500 pounds, maximum certificated takeoff weight, up to 300,000 pounds.
3. Small—Aircraft of 12,500 pounds or less maximum certificated takeoff weight. (Refer to AIM)

AIR DEFENSE EMERGENCY— A military emergency condition declared by a designated authority. This condition exists when an attack upon the continental U.S., Alaska, Canada, or U.S. installations in Greenland by hostile aircraft or missiles is considered probable, is imminent, or is taking place. (Refer to AIM)

AIR DEFENSE IDENTIFICATION ZONE/ADIZ— The area of airspace over land or water, extending upward from the surface, within which the ready identification, the location, and the control of aircraft are required in the interest of national security.

1. Domestic Air Defense Identification Zone— An ADIZ within the United States along an international boundary of the United States.
2. Coastal Air Defense Identification Zone— An ADIZ over the coastal waters of the United States.
3. Distant Early Warning Identification Zone (DEWIZ)— An ADIZ over the coastal waters of the State of Alaska.

ADIZ locations and operating and flight plan requirements for civil aircraft operations are specified in FAR Part 99. (Refer to AIM)

AIRMAN'S INFORMATION MANUAL/AIM— A publication containing Basic Flight Information and ATC Procedures designed primarily as a pilot's instructional manual for use in the National Airspace System of the United States.

ICAO-AERONAUTICAL INFORMATION PUBLICATION—A publication issued by or with the authority of a state and containing aeronautical information of a lasting character essential to air navigation.

AIRMET **/WA/AIRMAN'S METEOROLOGICAL INFORMATION—** In-flight weather advisories issued only to amend the area forecast concerning weather phenomena which are of operational interest to all aircraft and potentially hazardous to aircraft having limited capability because of lack of equipment, instrumentation, or pilot qualifications. AIRMET's concern weather of less severity than that covered by SIGMET's or Convective SIGMET's. AIRMET's cover moderate icing, moderate turbulence, sustained winds of 30 knots or more at the surface, widespread areas of ceilings less than 1,000 feet and/or visibility less than 3 miles, and extensive mountain obscurement. (See SIGMET, Convective SIGMET, and CWA) (Refer to AIM)

AIR NAVIGATION FACILITY— Any facility used in, available for use in, or designed for use in, aid of air navigation, including landing areas, lights, any apparatus or equipment for disseminating weather information, for signaling, for radio-directional finding, or for radio or other electrical communication, and any other structure or mechanism having a similar purpose for guiding or controlling flight in the air or the landing and take-off of aircraft. (See Navigational Aid)

AIRPORT— An area on land or water that is used or intended to be used for the landing and takeoff of aircraft and includes its buildings and facilities, if any.

AIRPORT ADVISORY AREA— The area within ten miles of an airport without a control tower or where the tower is not in operation, and on which a Flight Service Station is located. (See Airport Advisory Service) (Refer to AIM)

AIRPORT ADVISORY SERVICE/AAS— A service provided by flight service stations located at airports not serviced by a control tower. This service consists of providing information to arriving and departing aircraft concerning wind direction and speed, favored runway, altimeter setting, pertinent known traffic, pertinent known field conditions, airport taxi routes and traffic patterns, and authorized instrument approach procedures. This information is advisory in nature and does not constitute an ATC clearance. (See Airport Advisory Area)

AIRPORT ELEVATION/FIELD ELEVATION— The highest point of an airport's usable runways measured in feet from mean sea level. (See Touchdown Zone Elevation)

ICAO-AERODROME ELEVATION—The elevation of the highest point of the landing area.

AIRPORT/FACILITY DIRECTORY— A publication designed primarily as a pilot's operational manual containing all airports, seaplane bases, and heliports open to the public including communications data, navigational facilities, and certain special notices and procedures. This publication is issued in seven volumes according to geographical area.

AIRPORT INFORMATION DESK/AID— An airport unmanned facility designed for pilot self-service briefing, flight planning, and filing of flight plans. (Refer to AIM)

AIRPORT LIGHTING— Various lighting aids that may be installed on an airport. Types of airport lighting include:

1. Approach Light System/ALS—An airport lighting facility which provides visual guidance to landing aircraft by radiating light beams in a directional pattern by which the pilot aligns the aircraft with the extended centerline of the runway on his final approach for landing.

   Condenser-Discharge Sequential Flashing Lights/Sequenced Flashing Lights may be installed in conjunction with the ALS at some airports. Types of Approach Light Systems are:

   a. ALSF-I—Approach Light System with Sequenced Flashing Lights in ILS Cat-I configuration.
   b. ALSF-II—Approach Light System with Sequenced Flashing Lights in ILS Cat-II configuration.
   c. SSALF—Simplified Short Approach Light System with Sequenced Flashing Lights.
   d. SSALR—Simplified Short Approach Light System with Runway Alignment Indicator Lights.
   e. MALSF—Medium Intensity Approach Light System with Sequenced Flashing Lights.
   f. MALSR—Medium Intensity Approach Light System with Runway Alignment Indicator Lights.
   g. LDIN—Sequenced Flashing Lead-in Lights.
   h. RAIL—Runway Alignment Indicator Lights (Sequenced Flashing Lights which are installed only in combination with other light systems).
   i. ODALS—Omnidirectional Approach Lighting System consists of seven omnidirectional flashing lights located in the approach area of a nonprecision runway. Five lights are located on the runway centerline extended with the first light located 300 feet from the threshold and extending at equal intervals up to 1,500 feet from the threshold. The other two lights are located, one on each side of the runway threshold, at a lateral distance of 40 feet from the runway edge, or 75 feet from the runway edge when installed on a runway equipped with a VASI. (Refer to Order 6850.2A)

2. Runway Lights/Runway Edge Lights—Lights having a prescribed angle of emission used to define the lateral limits of a runway. Runway lights are uniformly spaced at intervals of approximately 200 feet, and the intensity may be controlled or preset.

3. Touchdown Zone Lighting—Two rows of tranverse light bars located symmetrically about the runway centerline normally at 100 foot intervals. The basic system extends 3,000 feet along the runway.

4. Runway Centerline Lighting—Flush centerline lights spaced at 50-foot intervals beginning 75 feet from the landing threshold and extending to within 75 feet of the opposite end of the runway.

5. Threshold Lights—Fixed green lights arranged symmetrically left and right of the runway centerline, identifying the runway threshold.

6. Runway End Identifier Lights/REIL—Two synchronized flashing lights, one on each side of the runway threshold, which provide rapid and positive identification of the approach end of a particular runway.

7. Visual Approach Slope Indicator/VASI— An airport lighting facility providing vertical visual approach slope guidance to aircraft during approach to landing by radiating a directional pattern of high intensity red and white focused light beams which indicate to the pilot that he is "on path" if he sees red/white, "above path' if white/white, and "below path" if red/red. Some airports serving large aircraft have three-bar VASIs which provide two visual glide paths to the same runway.

8. Boundary Lights—Lights defining the perimeter of an airport or landing area. (Refer to AIM)

AIRPORT MARKING AIDS— Markings used on runway and taxiway surfaces to identify a specific runway, a runway threshold, a centerline, a hold line, etc. A runway should be marked in accordance with its present usage such as:

1. Visual.

2. Nonprecision instrument.

3. Precision instrument. (Refer to AIM)

AIRPORT RADAR SERVICE AREA / ARSA— (See Controlled Airspace)

AIRPORT ROTATING BEACON— A visual NAVAID operated at many airports. At civil airports, alternating white and green flashes indicate the location of the airport. At military airports, the beacons flash alternately white and green, but are differentiated from civil beacons by dualpeaked (two quick) white flashes between the green flashes. (See Special VFR Operations, Instrument Flight Rules) (Refer to AIM, Rotating Beacons)

ICAO-AERODROME BEACON—Aeronautical beacon used to indicate the location of an aerodrome.

AIRPORT SURFACE DETECTION EQUIPMENT/ASDE— Radar equipment specifically designed to detect all principal features on the surface of an airport, including aircraft and vehicular traffic, and to present the entire image on a radar indicator console in the control tower. Used to augment visual observation by tower personnel of aircraft and/or vehicular movements on runways and taxiways.

AIRPORT SURVEILLANCE RADAR/ASR— Approach control radar used to detect and display an aircraft's position in the terminal area. ASR provides range and azimuth information but does not provide elevation data. Coverage of the ASR can extend up to 60 miles.

AIRPORT TRAFFIC AREA— Unless otherwise specifically designated in FAR Part 93, that airspace within a horizontal radius of 5 statute miles from the geographical center of any airport at which a control tower is operating, extending from the surface up to, but not including, an altitude of 3,000 feet above the elevation of an airport. Unless otherwise authorized or required by ATC, no person may operate an aircraft within an airport traffic area except for the purpose of landing at or taking off from an airport within that area. ATC authorizations may be given as individual approval of specific operations or may be contained in written agreements between airport users and the tower concerned. (Refer to FAR, Parts 1 and 91)

AIRPORT TRAFFIC CONTROL SERVICE— A service provided by a control tower for aircraft operating on the movement area and in the vicinity of an airport. (See Movement Area, Tower)

ICAO-AERODROME CONTROL SERVICE—Air traffic control service for aerodrome traffic.

AIR ROUTE SURVEILLANCE RADAR/ARSR— Air route traffic control center (ARTCC) radar used primarily to detect and display an aircraft's position while en route between terminal areas. The ARSR enables controllers to provide radar air traffic control service when aircraft are within the ARSR coverage. In some instances, ARSR may enable an ARTCC to provide terminal radar services similar to but usually more limited than those provided by a radar approach control.

AIR ROUTE TRAFFIC CONTROL CENTER/ARTCC— A facility established to provide air traffic control service to aircraft operating on IFR flight plans within controlled airspace and principally during the en route phase of flight. When equipment capabilities and controller workload permit, certain advisory/assistance services may be provided to VFR aircraft. (See NAS Stage A, En Route Air Traffic Control Service) (Refer to AIM)

AIRSPEED— The speed of an aircraft relative to its surrounding air mass. The unqualified term "airspeed' means one of the following:

1. Indicated Airspeed—The speed shown on the aircraft airspeed indicator. This is the speed used in pilot/controller communications under the general term "airspeed." (Refer to FAR Part 1)
2. True Airspeed—The airspeed of an aircraft relative to undisturbed air. Used primarily in flight planning and en route portion of flight. When used in pilot/controller communications, it is referred to as "true airspeed" and not shortened to "airspeed."

AIRSTART— The starting of an aircraft engine while the aircraft is airborne, preceded by engine shutdown during training flights or by actual engine failure.

AIR TAXI— Used to describe a helicopter/VTOL aircraft movement conducted above the surface but normally not above 100 feet AGL. The aircraft may proceed either via hover taxi or flight at speeds more than 20 knots. The pilot is solely responsible for selecting a safe airspeed/altitude for the operation being conducted. (See Hover Taxi) (Refer to AIM)

AIR TRAFFIC— Aircraft operating in the air or on an airport surface, exclusive of loading ramps and parking areas.

ICAO—AIR TRAFFIC—All aircraft in flight or operating on the maneuvering area of an aerodrome.

AIR TRAFFIC CLEARANCE/ATC CLEARANCE— An authorization by air traffic control, for the purpose of preventing collision between known aircraft, for an aircraft to proceed under specified traffic conditions within controlled airspace. (See ATC Instructions)

ICAO—AIR TRAFFIC CONTROL CLEARANCE—Authorization for an aircraft to proceed under conditions specified by an air traffic control unit.

AIR TRAFFIC CONTROL/ATC— A service operated by appropriate authority to promote the safe, orderly and expeditious flow of air traffic.

ICAO—AIR TRAFFIC CONTROL SERVICE—A service provided for the purpose of:

1. Preventing collisions:
   a. Between aircraft, and
   b. On the maneuvering area between aircraft and obstructions, and
2. Expediting and maintaining an orderly flow of air traffic.

AIR TRAFFIC CONTROL COMMAND CENTER/ATCCC— An Air Traffic Operations Service facility consisting of four operational units.

1. Central Flow Control Function/CFCF—Responsible for coordination and approval of all major intercenter flow control restrictions on a system basis in order to obtain maximum utilization of the airspace. (See Fuel Advisory Departure, Quota Flow Control)
2. Central Altitude Reservation Function/CARF—Responsible for coordinating, planning, and approving special user requirements under the Altitude Reservation (ALTRV) concept. (See Altitude Reservation)
3. Airport Reservation Office/ARO—Responsible for approving IFR flights at designated high density traffic airports (John F. Kennedy, LaGuardia, O'Hare, and Washington National) during specified hours. (Refer to FAR Part 93 and Airport/Facility Directory)
4. ATC Contingency Command Post—A facility which enables the FAA to manage the ATC system when significant portions of the system's capabilities have been lost or are threatened.

AIR TRAFFIC CONTROL SERVICE— (See Air Traffic Control)

AIR TRAFFIC CONTROL SPECIALIST/CONTROLLER— A person authorized to provide air traffic control service. (See Air Traffic Control, Flight Service Station)

*ICAO—CONTROLLER—*A person authorized to provide air traffic control services.

AIRWAY BEACON— Used to mark airway segments in remote mountain areas. The light flashes Morse Code to identify the beacon site. (Refer to AIM)

AIRWAY/FEDERAL AIRWAY— A control area or portion thereof established in the form of a corridor, the centerline of which is defined by radio navigational aids. (Refer to FAR Part 71, AIM)

*ICAO-AIRWAY—*A control area or portion thereof established in the form of corridor equipped with radio navigational aids.

ALERT AREA— (See Special Use Airspace)

ALERT NOTICE/ALNOT— A message sent by a flight service station (FSS) or an air route traffic control center (ARTCC) that requests an extensive communication search for overdue, unreported, or missing aircraft.

ALPHANUMERIC DISPLAY/DATA BLOCK— Letters and numerals used to show identification, altitude, beacon code, and other information concerning a target on a radar display. (See Automated Radar Terminal Systems, NAS Stage A)

ALTERNATE AIRPORT— An airport at which an aircraft may land if a landing at the intended airport becomes inadvisable.

*ICAO-ALTERNATE AERODROME—*An aerodrome specified in the flight plan to which a flight may proceed when it becomes inadvisable to land at the aerodrome of intended landing.

ALTIMETER SETTING— The barometric pressure reading used to adjust a pressure altimeter for variations in existing atmospheric pressure or to the standard altimeter setting (29.92). (Refer to FAR Part 91, AIM)

ALTITUDE— The height of a level, point, or object measured in feet Above Ground Level (AGL) or from Mean Sea Level (MSL). (See Flight Level)

1. MSL Altitude—Altitude expressed in feet measured from mean sea level.
2. AGL Altitude—Altitude expressed in feet measured above ground level.
3. Indicated Altitude—The altitude as shown by an altimeter. On a pressure or barometric altimeter it is altitude as shown uncorrected for instrument error and uncompensated for variation from standard atmospheric conditions.

*ICAO-ALTITUDE—*The vertical distance of a level, a point or an object considered as a point, measured from mean sea level.

ALTITUDE READOUT/AUTOMATIC ALTITUDE REPORT— An aircraft's altitude, transmitted via the Mode C transponder feature, that is visually displayed in 100-foot increments on a radar scope having readout capability. (See Automated Radar Terminal Systems, NAS Stage A, Alphanumeric Display) (Refer to AIM)

ALTITUDE RESERVATION/ALTRV— Airspace utilization under prescribed conditions normally employed for the mass movement of aircraft or other special user requirements which cannot otherwise be accomplished. ALTRVs are approved by the appropriate FAA facility. (See Air Traffic Control Command Center)

ALTITUDE RESTRICTION— An altitude or altitudes, stated in the order flown, which are to be maintained until reaching a specific point or time. Altitude restrictions may be issued by ATC due to traffic, terrain, or other airspace considerations.

ALTITUDE RESTRICTIONS ARE CANCELED— Adherence to previously imposed altitude restrictions is no longer required during a climb or descent.

APPROACH CLEARANCE— Authorization by ATC for a pilot to conduct an instrument approach. The type of instrument approach for which a clearance and other pertinent information is provided in the approach clearance when required. (See Instrument Approach Procedure, Cleared for Approach) (Refer to AIM and FAR Part 91)

APPROACH CONTROL FACILITY— A terminal ATC facility that provides approach control service in a terminal area. (See Approach Control Service, Radar Approach Control Facility.

APPROACH CONTROL SERVICE— Air traffic control service provided by an approach control facility for arriving and departing VFR/IFR aircraft and, on occasion, en route aircraft. At some airports not served by an approach control facility, the ARTCC provides limited approach control service. (Refer to AIM)

*ICAO—APPROACH CONTROL SERVICE—*Air traffic service for arriving or departing controlled flights.

APPROACH GATE— An imaginary point used within ATC as a basis for vectoring aircraft to the final approach course. The gate will be established along the final approach course 1 mile from the outer marker (or the fix used in lieu of the outer marker) on the side away from the airport for precision approaches and 1 mile from the final approach fix on the side away from the airport for nonprecision approaches. In either case when measured along the final approach course, the gate will be no closer than 5 miles from the landing threshold.

APPROACH LIGHT SYSTEM— (See Airport Lighting)

APPROACH SEQUENCE— The order in which aircraft are positioned while on approach or awaiting approach clearance. (See Landing Sequence)

ICAO—APPROACH SEQUENCE—The order in which two or more aircraft are cleared to approach to land at the aerodrome.

APPROACH SPEED— The recommended speed contained in aircraft manuals used by pilots when making an approach to landing. This speed will vary for different segments of an approach as well as for aircraft weight and configuration.

APRON/RAMP— A defined area on an airport or heliport intended to accommodate aircraft for purposes of loading or unloading passengers or cargo, refueling, parking, or maintenance. With regard to seaplanes, a ramp is used for access to the apron from the water.

ICAO—APRON—A defined area, on a land aerodrome, intended to accommodate aircraft for purposes of loading or unloading passengers or cargo, refueling, parking or maintenance.

ARC— The track over the ground of an aircraft flying at a constant distance from a navigational aid by reference to distance measuring equipment (DME).

AREA NAVIGATION/RNAV— A method of navigation that permits aircraft operation on any desired course within the coverage of station-referenced navigation signals or within the limits of a self-contained system capability. Random Area Navigation routes are direct routes, based on area navigation capability, between waypoints defined in terms of latitude/longitude coordinates, degree/distance fixes, or offsets from published or established routes/airways at a specified distance and direction. The major types of equipment are:

1. VORTAC referenced or Course Line Computer (CLC) systems, which account for the greatest number of RNAV units in use. To function, the CLC must be within the service range of a VORTAC.
2. OMEGA/VLF, although two separate systems, can be considered as one operationally. A long-range navigation system based upon Very Low Frequency radio signals transmitted from a total of 17 stations worldwide.
3. Inertial (INS) systems, which are totally self-contained and require no information from external references. They provide aircraft position and navigation information in response to signals resulting from inertial effects on components within the system.
4. MLS Area Navigation (MLS/RNAV), which provides area navigation with reference to an MLS ground facility.

   Random Area Navigation routes are direct routes, based on area navigation capability, between waypoints defined in terms of latitude/longitude coordinates, degree/distance fixes, or offsets from published or established routes/airways at a specified distance and direction.
5. LORAN-C is a long-range radio navigation system that uses ground waves transmitted at low frequency to provide user position information at ranges of up to 600 to 1,200 nautical miles at both en route and approach altitudes. The useable signal coverage areas are determined by the signal-to-noise ratio, the envelope-to -cycle difference, and the geometric relationship between the positions of the user and the transmitting stations.

ICAO—AREA NAVIGATION/RNAV—A method of navigation which permits aircraft operation on any desired flight path within the coverage of station-referenced navigation aids or within the limits of the capability of self-contained aids or a combination of these.

ARMY AVIATION FLIGHT INFORMATION BULLETIN/USAFIB— A bulletin that provides air operation data covering Army, National Guard, and Army Reserve aviation activities.

ARRESTING SYSTEM— A safety device consisting of two major components, namely, engaging or catching devices and energy absorption devices for the purpose of arresting both tailhook and/or nontailhook-equipped aircraft. It is used to prevent aircraft from overrunning runways when the aircraft cannot be stopped after landing or during aborted takeoff. Arresting systems have various names; e.g., arresting gear, hook device, wire barrier cable. (See Abort) (Refer to AIM)

ARRIVAL TIME— The time an aircraft touches down on arrival.

ARTCC— (See Air Route Traffic Control Center)

ASR APPROACH— (See Surveillance Approach)

ATC ADVISES— Used to prefix a message of noncontrol information when it is relayed to an aircraft by other than an air traffic controller. (See Advisory)

ATC ASSIGNED AIRSPACE/ATCAA— Airspace of defined vertical/lateral limits, assigned by ATC, for the purpose of providing air traffic segregation between the specified activities being conducted within the assigned airspace and other IFR air traffic. (See Military Operations Area, Alert Area)

ATC CLEARANCE— (See Air Traffic Clearance)

ATC CLEARS— Used to prefix an ATC clearance when it is relayed to an aircraft by other than an air traffic controller.

ATC INSTRUCTIONS— Directives issued by air traffic control for the purpose of requiring a pilot to take specific actions; e.g., "Turn left heading two five zero," "Go around," "Clear the runway." (Refer to FAR Part 91)

ATCRBS— (See Radar)

ATC REQUESTS— Used to prefix an ATC request when it is relayed to an aircraft by other than an air traffic controller.

AUTOMATED RADAR TERMINAL SYSTEMS/ARTS— The generic term for the ultimate in functional capability afforded by several automation systems. Each differs in functional capabilities and equipment. ARTS plus a suffix roman numeral denotes a specific system. A following letter indicates a major modification to that system. In general, an ARTS displays for the terminal controller aircraft identification, flight plan data, other flight associated information; e.g., altitude, speed, and aircraft position symbols in conjunction with his radar presentation. Normal radar co-exists with the alphanumeric display. In addition to enhancing visualization of the air traffic situation, ARTS facilitate intra/inter-facility transfer and coordination of flight information. These capabilities are enabled by specially designed computers and subsystems tailored to the radar and communications equipments and operational requirements of each automated facility. Modular design permits adoption of improvements in computer software and electronic technologies as they become available while retaining the characteristics unique to each system.

1. ARTS II—A programmable nontracking, computer- aided display subsystem capable of modular expansion. ARTS II systems provide a level of automated air traffic control capability at terminals having low to medium activity. Flight identification and altitude may be associated with the display of secondary radar targets. The system has the capability of communicating with ARTCC's and other ARTS II, IIA, III, and IIIA facilities.
2. ARTS IIA—A programmable radar-tracking computer subsystem capable of modular expansion. The ARTS IIA detects, tracks, and predicts secondary radar targets. The targets are displayed by means of computer- generated symbols, ground speed, and flight plan data. Although it does not track primary radar targets, they are displayed coincident with the secondary radar as well as the symbols and alphanumerics. The system has the capability of communicating with ARTCC's and other ARTS II, IIA, III, and IIIA facilities.
3. ARTS III—The Beacon Tracking Level (BTL) of the modular programmable automated radar terminal system in use at medium to high activity terminals. ARTS III detects, tracks, and predicts secondary radar-derived aircraft targets. These are displayed by means of computer-generated symbols and alphanumeric characters depicting flight identification, aircraft altitude, ground speed, and flight plan data. Although it does not track primary targets, they are displayed coincident with the secondary radar as well as the symbols and alphanumerics. The system has the capability of communicating with ARTCC's and other ARTS III facilities.
4. ARTS IIIA—The Radar Tracking and Beacon Tracking Level (RT&BTL) of the modular, programmable automated radar terminal system. ARTS IIIA detects, tracks, and predicts primary as well as secondary radar-derived aircraft targets. This more sophisticated computer-driven system upgrades the existing ARTS III system by providing improved tracking, continuous data recording, and fail-soft capabilities.

AUTOMATIC ALTITUDE REPORTING— That function of a transponder which responds to Mode C interrogations by transmitting the aircraft's altitude in 100-foot increments.

AUTOMATIC CARRIER LANDING SYSTEM/ ACLS— U.S. Navy final approach equipment consisting of precision tracking radar coupled to a computer data link to provide continuous information to the aircraft, monitoring capability to the pilot, and a backup approach system.

AUTOMATIC DIRECTION FINDER/ADF— An aircraft radio navigation system which senses and indicates the direction to a L/MF nondirectional radio beacon (NDB) ground transmitter. Direction is indicated to the pilot as a magnetic bearing or as a relative bearing to the longitudinal axis of the aircraft depending on the type of indicator installed in the aircraft. In certain applications, such as military, ADF operations may be based on airborne and ground transmitters in the VHF/UHF frequency spectrum. (See Bearing, Nondirectional Beacon)

AUTOMATIC TERMINAL INFORMATION SERVICE/ATIS— The continuous broadcast of recorded noncontrol information in selected terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information; e.g.,"Los Angeles information Alfa. One three zero zero Coordinated Universal Time. Weather, measured ceiling two thousand overcast, visibility three, haze, smoke, temperature seven one, dew point five seven, wind two five zero at five, altimeter two niner niner six. I-L-S Runway Two Five Left approach in use, Runway Two Five Right closed, advise you have Alfa." (Refer to AIM)

*ICAO—AUTOMATIC TERMINAL INFORMATION SERVICE—*The provision of current, routine information to arriving and departing aircraft by means of continuous and repetitive broadcasts throughout the day or a specified portion of the day.

AUTOROTATION— A rotorcraft flight condition in which the lifting rotor is driven entirely by action of the air when the rotorcraft is in motion.

1. Autorotative Landing/Touchdown Autorotation—Used by a pilot to indicate that he will be landing without applying power to the rotor.
2. Low Level Autorotation—Commences at an altitude well below the traffic pattern, usually below 100 feet AGL and is used primarily for tactical military training.
3. 180 degrees Autorotation—Initiated from a downwind heading and is commenced well inside the normal traffic pattern. "Go around" may not be possible during the latter part of this maneuver.

AVIATION WEATHER SERVICE— A service provided by the National Weather Service (NWS) and FAA which collects and disseminates pertinent weather information for pilots, aircraft operators, and ATC. Available aviation weather reports and forecasts are displayed at each NWS office and FAA FSS. (See En Route Flight Advisory Service, Transcribed Weather Broadcast, Weather Advisory, Pilots Automatic Telephone Weather Answering Service) (Refer to AIM)

AZIMUTH, MLS—A magnetic bearing extending from an MLS navigation facility. Note: azimuth bearings are described as magnetic and are referred to as "azimuth" in radio telephone communications.

BASE LEG— (See Traffic Pattern)

BEACON— (See Radar, Nondirectional Beacon, Marker Beacon, Airport Rotating Beacon, Aeronautical Beacon, Airway Beacon))

BEARING— The horizontal direction to or from any point, usually measured clockwise from true north, magnetic north, or some other reference point through 360 degrees. (See Nondirectional Beacon)

BELOW MINIMUMS— Weather conditions below the minimums prescribed by regulation for the particular action involved; e.g., landing minimums, takeoff minimums.

BLAST FENCE— A barrier that is used to divert or dissipate jet or propeller blast.

BLIND SPEED— The rate of departure or closing of a target relative to the radar antenna at which cancellation of the primary radar target by moving target indicator (MTI) circuits in the radar equipment causes a reduction or complete loss of signal.

ICAO—BLIND VELOCITY—The radial velocity of a moving target such that the target is not seen on primary radars fitted with certain forms of fixed echo suppression.

BLIND SPOT/BLIND ZONE— An area from which radio transmissions and/or radar echoes cannot be received. The term is also used to describe portions of the airport not visible from the control tower.

BOUNDARY LIGHTS— (See Airport Lighting)

BRAKING ACTION (GOOD, FAIR, POOR, OR NIL)— A report of conditions on the airport movement area providing a pilot with a degree/quality of braking that he might expect. Braking action is reported in terms of good, fair, poor, or nil. (See Runway Condition Reading)

BRAKING ACTION ADVISORIES— When tower controllers have received runway braking action reports which include the terms "poor" or "nil," or whenever weather conditions are conducive to deteriorating or rapidly changing runway braking conditions, the tower will include on the ATIS broadcast the statement, "BRAKING ACTION ADVISORIES ARE IN EFFECT." During the time Braking Action Advisories are in effect, ATC will issue the latest braking action report for the runway in use to each arriving and departing aircraft. Pilots should be prepared for deteriorating braking conditions and should request current runway condition information if not volunteered by controllers. Pilots should also be prepared to provide a descriptive runway condition report to controllers after landing.

BROADCAST— Transmission of information for which an acknowledgement is not expected.

ICAO—BROADCAST—A transmission of information relating to air navigation that is not addressed to a specific station or stations.

CALL UP— Initial voice contact between a facility and an aircraft, using the identification of the unit being called and the unit initiating the call. (Refer to AIM)

CARDINAL ALTITUDES OR FLIGHT LEVELS— "Odd" or "Even" thousand-foot altitudes or flight levels; e.g., 5,000, 6,000, 7,000, FL 250, FL 260, FL 270. (See Altitude, Flight Levels)

CEILING— The heights above the earth's surface of the lowest layer of clouds or obscuring phenomena that is reported as "broken," "overcast," or "obscuration," and not classified as "thin" or "partial".

ICAO—CEILING—The height above the ground or water of the base of the lowest layer of cloud below 6,000 meters (20,000 feet) covering more than half the sky.

CELESTIAL NAVIGATION— The determination of geographical position by reference to celestial bodies. Normally used in aviation as a secondary means of position determination.

CENTER— (See Air Route Traffic Control Center)

CENTER'S AREA— The specified airspace within which an air route traffic control center (ARTCC) provides air traffic control and advisory service. (See Air Route Traffic Control Center) (Refer to AIM)

CENTER WEATHER ADVISORY/CWA— An unscheduled weather advisory issued by Center Weather Service Unit meteorologists for ATC use to alert pilots of existing or anticipated adverse weather conditions within the next 2 hours. A CWA may modify or redefine a SIGMET. (See SIGMET, Convective SIGMET, and AIRMET) (Refer to AIM)

CHAFF— Thin, narrow metallic reflectors of various lengths and frequency responses, used to reflect radar energy. These reflectors when dropped from aircraft and allowed to drift downward result in large targets on the radar display.

CHARTED VFR FLYWAYS— Charted VFR Flyways are flight paths recommended for use to bypass areas heavily traversed by large turbine-powered aircraft. Pilot compliance with recommended flyways and associated altitudes is strictly voluntary. VFR Flyway Planning charts are published on the back of existing VFR Terminal Area charts.

CHARTED VISUAL FLIGHT PROCEDURE (CVFP) APPROACH— An approach wherein a radar-controlled aircraft on an IFR flight plan, operating in VFR conditions and having an ATC authorization, may proceed to the airport of intended landing via visual landmarks and altitudes depicted on a charted visual flight procedure.

CHASE/CHASE AIRCRAFT— An aircraft flown in proximity to another aircraft normally to observe its performance during training or testing.

CIRCLE-TO-LAND MANEUVER/CIRCLING MANEUVER— A maneuver initiated by the pilot to align the aircraft with a runway for landing when a straight-in landing from an instrument approach is not possible or is not desirable. This maneuver is made only after ATC authorization has been obtained and the pilot has established required visual reference to the airport (See Circle to Runway, Landing Minimums) (Refer to AIM)

CIRCLE TO RUNWAY (RUNWAY NUMBERED)— Used by ATC to inform the pilot that he must circle to land because the runway in use is other than the runway aligned with the instrument approach procedure. When the direction of the circling maneuver in relation to the airport/runway is required, the controller will state the direction (eight cardinal compass points) and specify a left or right downwind or base leg as appropriate; e.g., "Cleared VOR Runway Three Six Approach circle to Runway Two Two," or "Circle northwest of the airport for a right downwind to Runway Two Two." (See Circle-to-Land Maneuver, Landing Minimums) (Refer to AIM)

CIRCLING APPROACH— (See Circle-to-Land Maneuver)

CIRCLING MINIMA— (See Landing Minimums)

CLEAR-AIR TURBULENCE/CAT— Turbulence encountered in air where no clouds are present. This term is commonly applied to high-level turbulence associated with wind shear. CAT is often encountered in the vicinity of the jet stream. (See Wind Shear, Jet Stream)

CLEARANCE— (See Air Traffic Clearance)

CLEARANCE LIMIT— The fix, point, or location to which an aircraft is cleared when issued an air traffic clearance.

*ICAO—CLEARANCE LIMIT—*The point of which an aircraft is granted an air traffic control clearance.

CLEARANCE VOID IF NOT OFF BY (TIME)— Used by ATC to advise an aircraft that the departure clearance is automatically cancelled if takeoff is not made prior to a specified time. The pilot must obtain a new clearance or cancel his IFR flight plan if not off by the specified time.

ICAO—CLEARANCE VOID TIME— A time specified by an air traffic control unit at which a clearance ceases to be valid unless the aircraft concerned has already taken action to comply therewith.

CLEARED AS FILED— Means the aircraft is cleared to proceed in accordance with the route of flight filed in the flight plan. This clearance does not include the altitude, SID, or SID Transition. (See Request Full Route Clearance) (Refer to AIM)

CLEARED FOR (Type Of) APPROACH— ATC authorization for an aircraft to execute a specific instrument approach procedure to an airport; e.g., "Cleared for ILS Runway Three Six Approach." (See Instrument Approach Procedure, Approach Clearance) (Refer to AIM, FAR Part 91)

CLEARED FOR APPROACH— ATC authorization for an aircraft to execute any standard or special instrument approach procedure for that airport. Normally, an aircraft will be cleared for a specific instrument approach procedure. (See Instrument Approach Procedure, Cleared for (Type of) Approach) (Refer to AIM, FAR Part 91)

CLEARED FOR TAKEOFF— ATC authorization for an aircraft to depart. It is predicated on known traffic and known physical airport conditions.

CLEARED FOR THE OPTION— ATC authorization for an aircraft to make a touch-and-go, low approach, missed approach, stop and go, or full stop landing at the discretion of the pilot. It is normally used in training so that an instructor can evaluate a student's performance under changing situations. (See Option Approach) (Refer to AIM)

CLEARED THROUGH— ATC authorization for an aircraft to make intermediate stops at specified airports without refiling a flight plan while en route to the clearance limit.

CLEARED TO LAND— ATC authorization for an aircraft to land. It is predicated on known traffic and known physical airport conditions.

CLEARWAY— An area beyond the takeoff runway under the control of airport authorities within which terrain or fixed obstacles may not extend above specified limits. These areas may be required for certain turbine-powered operations and the size and upward slope of the clearway will differ depending on when the aircraft was certificated. (Refer to FAR Part 1)

CLIMBOUT— That portion of flight operation between takeoff and the initial cruising altitude. in the event of two-way communication failure. It also provides altitude

CLIMB TO VFR— ATC authorization for an aircraft to climb to VFR conditions within a control zone when the only weather limitation is restricted visibility. The aircraft must remain clear of clouds while climbing to VFR. (See Special VFR) (Refer to AIM)

CLOSED RUNWAY— A runway that is unusable for aircraft operations. Only the airport management/military operations office can close a runway.

CLOSED TRAFFIC— Successive operations involving takeoffs and landings or low approaches where the aircraft does not exit the traffic pattern.

CLUTTER— In radar operations, clutter refers to the reception and visual display of radar returns caused by precipitation, chaff, terrain, numerous aircraft targets, or other phenomena. Such returns may limit or preclude ATC from providing services based on radar. (See Ground Clutter, Chaff, Precipitation, Target)

*ICAO—Radar Clutter—*The visual indication on a radar display of unwanted signals.

COASTAL FIX— A navigation aid or intersection where an aircraft transitions between the domestic route structure and the oceanic route structure.

CODES/TRANSPONDER CODES— The number assigned to a particular multiple pulse reply signal transmitted by a transponder. (See Discrete Code)

COMBINED CENTER-RAPCON/CERAP— An air traffic facility which combines the functions of an ARTCC and a radar approach control facility. (See Air Route Traffic Control Center/ARTCC, Radar Approach Control Facility)

COMMON ROUTE/COMMON PORTION— That segment of a North American Route between the inland navigation facility and the coastal fix.

COMMON TRAFFIC ADVISORY FREQUENCY/CTAF— A frequency designed for the purpose of carrying out airport advisory practices while operating to or from an uncontrolled airport. The CTAF may be a UNICOM, Multicom, FSS, or tower frequency and is identified in appropriate aeronautical publications. (Refer to AC—90-42C)

COMPASS LOCATOR— A low power, low or medium frequency (L/MF) radio beacon installed at the site of the outer or middle marker of an instrument landing system (ILS). It can be used for navigation at distances of approximately 15 miles or as authorized in the approach procedure.

1. Outer Compass Locator/LOM—A compass locator installed at the site of the outer marker of an instrument landing system. (See Outer Marker)
2. Middle Compass Locator/LMM—A compass locator installed at the site of the middle marker of an instrument landing system. (See Middle Marker)

ICAO—LOCATOR—An LM/MF NDB used as an aid to final approach.

COMPASS ROSE— A circle, graduated in degrees, printed on some charts or marked on the ground at an airport. It is used as a reference to either true or magnetic direction.

COMPOSITE FLIGHT PLAN— A flight plan which specifies VFR operation for one portion of flight and IFR for another portion. It is used primarily in military operations. (Refer to AIM)

COMPOSITE ROUTE SYSTEM— An organized oceanic route structure, incorporating reduced lateral spacing between routes, in which composite separation is authorized.

COMPOSITE SEPARATION— A method of separating aircraft in a composite route system where, by management of route and altitude assignments, a combination of half the lateral minimum specified for the area concerned and half the vertical minimum is applied.

COMPULSORY REPORTING POINTS— Reporting points which must be reported to ATC. They are designated on aeronautical charts by solid triangles or filed in a flight plan as fixes selected to define direct routes. These points are geographical locations which are defined by navigation aids/fixes. Pilots should discontinue position reporting over compulsory reporting points when informed by ATC that their aircraft is in "radar contact."

CONFLICT ALERT— A function of certain air traffic control automated systems designed to alert radar controllers to existing or pending situations recognized by the program parameters that require his immediate attention/action.

CONFLICT RESOLUTION— The resolution of potential conflictions between IFR aircraft and VFR aircraft that are radar identified and in communication with ATC by ensuring that radar targets do not touch. Pertinent traffic advisories shall be issued when this procedure is applied. Note: This separation procedure will not be provided utilizing fully digitized radar systems. (See Controlled Airspace—Airport Radar Service Area / ARSA, Outer Area)

CONSOLAN— A low frequency, long-distance NAVAID used principally for transoceanic navigations.

CONTACT—

1. Establish communication with (followed by the name of the facility and, if appropriate, the frequency to be used).
2. A flight condition wherein the pilot ascertains the attitude of his aircraft and navigates by visual reference to the surface. (See Contact Approach, Radar Contact)

CONTACT APPROACH— An approach wherein an aircraft on an IFR flight plan, having an air traffic control authorization, operating clear of clouds with at least 1 mile flight visibility and a reasonable expectation of continuing to the destination airport in those conditions, may deviate from the instrument approach procedure and proceed to the destination airport by visual reference to the surface. This approach will only be authorized when requested by the pilot and the reported ground visibility at the destination airport is at least 1 statute mile. (Refer to AIM)

CONTERMINOUS U.S.— The 48 adjoining States and the District of Columbia.

CONTINENTAL CONTROL AREA— (See Controlled Airspace)

CONTINENTAL UNITED STATES— The 49 States located on the continent of North America and the District of Columbia.

CONTROL AREA— (See Controlled Airspace)

CONTROLLED AIRSPACE— Airspace designated as a control zone, airport radar service area, terminal control area, transition area, control area, continental control area, and positive control area within which some or all aircraft may be subject to air traffic control. (Refer to AIM, FAR Part 71)

ICAO—CONTROLLED AIRSPACE—Airspace of defined dimensions within which air traffic control service is provided to controlled flights.

Types of U.S. Controlled Airspace:

1. Control Zone—Controlled airspace which extends upward from the surface of the earth and terminates at the base of the continental control area. Control zones that do not underlie the continental control area have no upper limit. A control zone may include one or more airports and is normally a circular area with a radius of 5 statute miles and any extensions necessary to include instrument approach and departure paths.

ICAO—Control Zone—A controlled airspace extending upwards from the surface of the earth to a specified upper limit.

2. Airport Radar Service Area / ARSA—Regulatory airspace surrounding designated airports wherein ATC provides radar vectoring and sequencing on a full-time basis for all IFR and VFR aircraft. The service provided in an ARSA is called ARSA service which includes: IFR/IFR—standard IFR separation; IFR/VFR—traffic advisories and conflict resolution; and VFR/VFR—traffic advisories and, as appropriate, safety alerts. The AIM contains an explanation of ARSA. The ARSA's are depicted on VFR aeronautical charts. (See Conflict Resolution, Outer Area) (Refer to AIM, Airport/Facility Directory, FAR Part 91)

3. Terminal Control Area/TCA—Controlled airspace extending upward from the surface or higher to specified altitudes, within which all aircraft are subject to operating rules and pilot and equipment requirements specified in FAR Part 91. TCA's are depicted on Sectional, World Aeronautical, En Route Low Altitude, DOD FLIP, and TCA charts. (Refer to FAR Part 91, AIM)

ICAO—Terminal Control Area—A control area normally established at the confluence of ATS routes in the vicinity of one or more major aerodromes.

4. Transition Area—Controlled airspace extending upward from 700 feet or more above the surface of the earth when designated in conjunction with an airport for which an approved instrument approach procedure has been prescribed; or from 1,200 feet or more above the surface of the earth when designated in conjunction with airway route structures or segments. Unless otherwise specified, transition areas terminate at the base of the overlying controlled airspace. Transition areas are designed to contain IFR operations in controlled airspace during portions of the terminal operation and while transiting between the terminal and en route environment.

5. Control Area—Airspace designated as Colored Federal airways, VOR Federal airways, control areas associated with jet routes outside the continental control area (FAR 71.161), additional control areas (FAR 71.163), control area extensions (FAR 71.165), and area low routes. Control areas do not include the continental control area, but unless otherwise designated, they do include the airspace between a segment of a main VOR Federal airway and its associated alternate segments with the vertical extent of the area corresponding to the vertical extent of the related segment of the main airway. The vertical extent of the various categories of airspace contained in control areas is defined in FAR Part 71.

ICAO—Control Area—A controlled airspace extending upward from a specified limit above the earth.

6. Continental Control Area—The airspace of the 48 contiguous States, the District of Columbia and Alaska, excluding the Alaska peninsula west of Long. 160° 00' 00"W, at and above 14,500 feet MSL, but does not include:

   a. The airspace less than 1,500 feet above the surface of the earth; or

   b. Prohibited and restricted areas, other than the restricted areas listed in FAR Part 71.

7. Positive Control Area/PCA—Airspace designated in FAR, Part 71 within which there is positive control of aircraft. Flight in PCA is normally conducted under instrument flight rules. PCA is designated throughout most of the conterminous United States and its vertical extent is from 18,000 feet MSL to and including flight level 600. In Alaska PCA does not include the airspace less than 1,500 feet above the surface of the earth nor the airspace over the Alaska Peninsula west of longitude 160 degrees West. Rules for operating in PCA are found in FARs 91.97 and 91.24.

CONTROLLED DEPARTURE TIME (CDT) PROGRAMS— These programs are the flow control process whereby aircraft are held on the ground at the departure airport when delays are projected to occur in either the en route system or the terminal of intended landing. The purpose of these programs is to reduce congestion in the air traffic system or to limit the duration of airborne holding in the arrival center or terminal area. A CDT is a specific departure slot shown on the flight plan as an expected departure clearance time (EDCT).

CONTROLLER— (See Air Traffic Control Specialist)

CONTROL SECTOR— An airspace area of defined horizontal and vertical dimensions for which a controller or group of controllers has air traffic control responsibility, normally within an air route traffic control center or an approach control facility. Sectors are established based on predominant traffic flows, altitude strata, and controller workload. Pilot-communications during operations within a sector are normally maintained on discrete frequencies assigned to the sector. (See Discrete Frequency)

CONTROL SLASH— A radar beacon slash representing the actual position of the associated aircraft. Normally, the control slash is the one closest to the interrogating radar beacon site. When ARTCC radar is operating in narrowband (digitized) mode, the control slash is converted to a target symbol.

CONTROL ZONE— (See Controlled Airspace)

***CONVECTIVE SIGMET* /WST/CONVECTIVE SIGNIFICANT METEOROLOGICAL INFORMATION—** A weather advisory concerning convective weather significant to the safety of all aircraft. Convective SIGMET's are issued for tornadoes, lines of thunderstorms, embedded thunderstorms of any intensity level, areas of thunderstorms greater than or equal to VIP level 4 with an areal coverage of 4/10 (40%) or more, and hail 3/4 inch or greater. (See SIGMET, CWA, and AIRMET) (Refer to AIM)

COORDINATES— The intersection of lines of reference, usually expressed in degrees/minutes/seconds of latitude and longitude, used to determine position or location.

COORDINATION FIX— The fix in relation to which facilities will handoff, transfer control of an aircraft, or coordinate flight progress data. For terminal facilities, it may also serve as a clearance for arriving aircraft.

CORRECTION— An error has been made in the transmission and the correct version follows.

COURSE—

1. The intended direction of flight in the horizontal plane measured in degrees from north.
2. The ILS localizer signal pattern usually specified as the front course or the back course.
3. The intended track along a straight, curved, or segmented MLS path.

   (See Bearing, Radial, Instrument Landing System, Microwave Landing System)

CRITICAL ENGINE— The engine which, upon failure, would most adversely affect the performance or handling qualities of an aircraft.

CROSS (FIX) AT (ALTITUDE)— Used by ATC when a specific altitude restriction at a specified fix is required.

CROSS (FIX) AT OR ABOVE (ALTITUDE)— Used by ATC when an altitude restriction at a specified fix is required. It does not prohibit the aircraft from crossing the fix at a higher altitude than specified; however, the higher altitude may not be one that will violate a succeeding altitude restriction or altitude assignment. (See Altitude Assignment, Altitude Restriction.) (Refer to AIM)

CROSS (FIX) AT OR BELOW (ALTITUDE)— Used by ATC when a maximum crossing altitude at a specific fix is required. It does not prohibit the aircraft from crossing the fix at a lower altitude; however, it must be at or above the minimum IFR altitude. (See Minimum IFR Altitude, Altitude Restriction) (Refer to FAR Part 91)

CROSSWIND—

1. When used concerning the traffic pattern, the word means "crosswind leg." (See Traffic Pattern)
2. When used concerning wind conditions, the word means a wind not parallel to the runway or the path of an aircraft. (See Crosswind Component)

CROSSWIND COMPONENT— The wind component measured in knots at 90 degrees to the longitudinal axis of the runway.

CRUISE— Used in an ATC clearance to authorize a pilot to conduct flight at any altitude from the minimum IFR altitude up to and including the altitude specified in the clearance. The pilot may level off at any intermediate altitude within this block of airspace. Climb/descent within the block is to be made at the discretion of the pilot. However, once the pilot starts descent and verbally reports leaving an altitude in the block, he may not return to that altitude without additional ATC clearance. Further, it is approval for the pilot to proceed to and make an approach at destination airport and can be used in conjunction with:

1. An airport clearance limit at locations with a standard/special instrument approach procedure. The FAR's require that if an instrument letdown to an airport is necessary, the pilot shall make the letdown in accordance with a standard/special instrument approach procedure for that airport, or
2. An airport clearance limit at locations that are within/below/outside controlled airspace and without a standard/special instrument approach procedure. Such a clearance is NOT AUTHORIZATION for the pilot to descend under IFR conditions below the applicable minimum IFR altitude nor does it imply that ATC is exercising control over aircraft in uncontrolled airspace; however, it provides a means for the aircraft to proceed to destination airport, descend, and land in accordance with applicable FAR's governing VFR flight operations. Also, this provides search and rescue protection until such time as the IFR flight plan is closed. (See Instrument Approach Procedure)

CRUISING ALTITUDE/LEVEL— An altitude or flight level maintained during en route level flight. This is a constant altitude and should not be confused with a cruise clearance. (See Altitude)

*ICAO—CRUISING LEVEL—*A level maintained during a significant portion of a flight.

DECISION HEIGHT/DH— With respect to the operation of aircraft, means the height at which a decision must be made during an ILS, MLS, or PAR instrument approach to either continue the approach or to execute a missed approach.

*ICAO—DECISION HEIGHT—*A specified height at which a missed approach must be initiated if the required visual reference to continue the approach to land has not been established.

DECODER— The device used to decipher signals received from ATCRBS transponders to effect their display as select codes. (See Codes, Radar)

DEFENSE VISUAL FLIGHT RULES/DVFR— Rules applicable to flights within an ADIZ conducted under the visual flight rules in FAR, Part 91. (See Air Defense Identification Zone) (Refer to FAR, Part 99)

DELAY INDEFINITE (REASON IF KNOWN) EXPECT FURTHER CLEARANCE (TIME)— Used by ATC to inform a pilot when an accurate estimate of the delay time and the reason for the delay cannot immediately be determined; e.g., a disabled aircraft on the runway, terminal or center area saturation, weather below landing minimums, etc. (See Expect Further Clearance)

DEPARTURE CONTROL— A function of an approach control facility providing air traffic control service for departing IFR and, under certain conditions, VFR aircraft. (See Approach Control) (Refer to AIM)

DEPARTURE TIME— The time an aircraft becomes airborne.

DEVIATIONS—

1. A departure from a current clearance, such as an off course maneuver to avoid weather or turbulence.
2. Where specifically authorized in the FAR's and requested by the pilot, ATC may permit pilots to deviate from certain regulations. (Refer to AIM)

DF APPROACH PROCEDURE— Used under emergency conditions where another instrument approach procedure cannot be executed. DF guidance for an instrument approach is given by ATC facilities with DF capability. (See DF Guidance, Direction Finder) (Refer to AIM)

DF FIX— The geographical location of an aircraft obtained by one or more direction finders. (See Direction Finder)

DF GUIDANCE/DF STEER— Headings provided to aircraft by facilities equipped with direction finding equipment. These headings, if followed, will lead the aircraft to a predetermined point such as the DF station or an airport. DF guidance is given to aircraft in distress or to other aircraft which request the service. Practice DF guidance is provided when workload permits. (See Direction Finder, DF Fix) (Refer to AIM)

DIRECT— Straight line flight between two navigational aids, fixes, points, or any combination thereof. When used by pilots in describing off-airway routes, points defining direct route segments become compulsory reporting points unless the aircraft is under radar contact.

DIRECT ALTITUDE AND IDENTITY READOUT/DAIR— The DAIR System is a modification to the AN/TPX-42 Interrogator System. The Navy has two adaptations of the DAIR System— Carrier Air Traffic Control Direct Altitude and Identification Readout System for Aircraft Carriers and Radar Air Traffic Control Facility Direct Altitude and Identity Readout System for land-based terminal operations. The DAIR detects, tracks, and predicts secondary radar aircraft targets. Targets are displayed by means of computer-generated symbols and alphanumeric characters depicting flight identification, altitude, ground speed, and flight plan data. The DAIR System is capable of interfacing with ARTCC's.

DIRECTION FINDER/DF/UDF/VDF/UVDF— A radio receiver equipped with a directional sensing antenna used to take bearings on a radio transmitter. Specialized radio direction finders are used in aircraft as air navigation aids. Others are ground-based, primarily to obtain a "fix" on a pilot requesting orientation assistance or to locate downed aircraft. A location "fix" is established by the intersection of two or more bearing lines plotted on a navigational chart using either two separately located Direction Finders to obtain a fix on an aircraft or by a pilot plotting the bearing indications of his DF on two separately located ground-based transmitters, both of which can be identified on his chart. UDF's receive signals in the ultra high frequency radio broadcast band; VDF's in the very high frequency band; and UVDF's in both bands. ATC provides DF service at those air traffic control towers and flight service stations listed in the Airport/Facility Directory and the DOD FLIP IFR En Route Supplement. (See DF Guidance, DF Fix)

DISCRETE CODE/DISCRETE BEACON CODE— As used in the Air Traffic Control Radar Beacon System (ATCRBS), any one of the 4096 selectable Mode 3/A aircraft transponder codes except those ending in zero zero; e.g., discrete codes: 0010, 1201, 2317, 7777; non-discrete codes: 0100, 1200, 7700. Non-discrete codes are normally reserved for radar facilities that are not equipped with discrete decoding capability and for other purposes such as emergencies (7700), VFR aircraft (1200), etc. (See Radar) (Refer to AIM)

DISCRETE FREQUENCY— A separate radio frequency for use in direct pilot-controller communications in air traffic control which reduces frequency congestion by controlling the number of aircraft operating on a particular frequency at one time. Discrete frequencies are normally designated for each control sector in en route/terminal ATC facilities. Discrete frequencies are listed in the Airport/Facility Directory and the DOD FLIP IFR En Route Supplement. (See Control Sector)

DISPLACED THRESHOLD— A threshold that is located at a point on the runway other than the designated beginning of the runway. (See Threshold) (Refer to AIM)

DISTANCE MEASURING EQUIPMENT/DME— Equipment (airborne and ground) used to measure, in nautical miles, the slant range distance of an aircraft from the DME navigational aid. (See TACAN, VORTAC, Microwave Landing System)

DISTRESS— A condition of being threatened by serious and/or imminent, danger, and of requiring immediate assistance.

DME FIX— A geographical position determined by reference to a navigational aid which provides distance and azimuth information. It is defined by a specific distance in nautical miles and a radial, azimuth, or course (i.e., localizer) in degrees magnetic from that aid. (See Distance Measuring Equipment/DME, Fix, Microwave Landing System)

DME SEPARATION— Spacing of aircraft in terms of distances (nautical miles) determined by reference to distance measuring equipment (DME). (See Distance Measuring Equipment)

DOD FLIP— Department of Defense Flight Information Publications used for flight planning, en route, and terminal operations. FLIP is produced by the Defense Mapping Agency for world-wide use. United States Government Flight Information Publications (en route charts and instrument approach procedure charts) are incorporated in DOD FLIP for use in the National Airspace System (NAS).

DOWNWIND LEG— (See Traffic Pattern)

DRAG CHUTE— A parachute device installed on certain aircraft which is deployed on landing roll to assist in deceleration of the aircraft.

EMERGENCY— A DISTRESS or URGENCY condition.

EMERGENCY LOCATOR TRANSMITTER/ELT— A radio transmitter attached to the aircraft structure which operates from its own power source on 121.5 MHz and 243.0 MHz. It aids in locating downed aircraft by radiating a downward sweeping audio tone, 2-4 times per second. It is designed to function without human action after an accident. (Refer to FAR, Part 91, AIM)

EMERGENCY SAFE ALTITUDE— (See Minimum Safe Altitude)

E-MSAW— (See En Route Minimum Safe Altitude Warning)

EN ROUTE AIR TRAFFIC CONTROL SERVICES— Air traffic control service provided aircraft on IFR flight plans, generally by centers, when these aircraft are operating between departure and destination terminal areas. When equipment, capabilities, and controller workload permit, certain advisory/assistance services may be provided to VFR aircraft. (See NAS Stage A, Air Route Traffic Control Center) (Refer to AIM)

EN ROUTE AUTOMATED RADAR TRACKING SYSTEM/EARTS— An automated radar and radar beacon tracking system. Its functional capabilities and design are essentially the same as the terminal ARTS IIIA system except for the EARTS capability of employing both short-range (ASR) and long-range (ARSR) radars, use of full digital radar displays, and fail-safe design. (See Automated Radar Terminal Systems/ARTS)

EN ROUTE CHARTS— (See Aeronautical Charts)

EN ROUTE DESCENT— Descent from the en route cruising altitude which takes place along the route of flight.

EN ROUTE FLIGHT ADVISORY SERVICE/FLIGHT WATCH— A service specifically designed to provide, upon pilot request, timely weather information pertinent to his type of flight, intended route of flight, and altitude. The FSS's providing this service are listed in the Airport/Facility Directory. (Refer to AIM)

EN ROUTE MINIMUM SAFE ALTITUDE WARNING/E-MSAW— A function of the NAS Stage A en route computer that aids the controller by alerting him when a tracked aircraft is below or predicted by the computer to go below a predetermined minimum IFR altitude (MIA).

ICAO—ESTIMATED ELAPSED TIME/EET—The estimated time required to proceed from one significant point to another (for use in international flight planning). (See Total Estimated Elapsed Time)

ICAO—ESTIMATED OFF-BLOCK TIME—The estimated time at which the aircraft will commence movement associated with departure (for use in international flight planning).

EXECUTE MISSED APPROACH— Instructions issued to a pilot making an instrument approach which means continue inbound to the missed approach point and execute the missed approach procedure as described on the Instrument Approach Procedure Chart or as previously assigned by ATC. The pilot may climb immediately to the altitude specified in the missed approach procedure upon making a missed approach. No turns should be initiated prior to reaching the missed approach point. When conducting an ASR or PAR approach, execute the assigned missed approach procedure immediately upon receiving instructions to "execute missed approach." (Refer to AIM)

EXPECT (ALTITUDE) AT (TIME) or (FIX)— Used under certain conditions to provide a pilot with an altitude to be used in the event of two-way communications failure. It also provides altitude information to assist the pilot in planning. (Refer to AIM)

EXPECTED DEPARTURE CLEARANCE TIME/EDCT— The runway release time assigned to an aircraft in a controlled departure time program and shown on the flight progress strip as an EDCT.

EXPECT FURTHER CLEARANCE (TIME)/EFC— The time a pilot can expect to receive clearance beyond a clearance limit.

EXPECT FURTHER CLEARANCE VIA (AIRWAYS, ROUTES OR FIXES)— Used to inform a pilot of the routing he can expect if any part of the route beyond a short range clearance limit differs from that filed.

EXPEDITE— Used by ATC when prompt compliance is required to avoid the development of an imminent situation.

FAST FILE— A system whereby a pilot files a flight plan via telephone that is tape recorded and then transcribed for transmission to the appropriate air traffic facility. Locations having a fast file capability are contained in the Airport/Facility Directory. (Refer to AIM)

FEATHERED PROPELLER— A propeller whose blades have been rotated so that the leading and trailing edges are nearly parallel with the aircraft flight path to stop or minimize drag and engine rotation. Normally used to indicate shutdown of a reciprocating or turboprop engine due to malfunction.

FEEDER ROUTE— A route depicted on instrument approach procedure charts to designate routes for aircraft to proceed from the en route structure to the initial approach fix (IAF). (See Instrument Approach Procedure)

FERRY FLIGHT— A flight for the purpose of:

1. Returning an aircraft to base,
2. Delivering an aircraft from one location to another.
3. Moving an aircraft to and from a maintenance base.

Ferry flights, under certain conditions, may be conducted under terms of a special flight permit.

FILED— Normally used in conjunction with flight plans, meaning a flight plan has been submitted to ATC.

FILED EN ROUTE DELAY— Any of the following preplanned delays at points/areas along the route of flight which require special flight plan filing and handling techniques.

1. Terminal Area Delay—A delay within a terminal area for touch-and-go, low approach, or other terminal area activity.
2. Special Use Airspace Delay—A delay within a Military Operating Area, Restricted Area, Warning Area, or ATC Assigned Airspace.
3. Aerial Refueling Delay—A delay within an Aerial Refueling Track or Anchor.

FINAL— Commonly used to mean that an aircraft is on the final approach course or is aligned with a landing area. (See Final Approach Course, Final Approach—IFR, Traffic Pattern, Segments of an Instrument Approach Procedure)

FINAL APPROACH COURSE— A published MLS course, a straight line extension of a localizer, a final approach radial/bearing, or a runway centerline all without regard to distance. (See Final Approach—IFR, Traffic Pattern)

FINAL APPROACH FIX/FAF— The fix from which the final approach (IFR) to an airport is executed and which identifies the beginning of the final approach segment. It is designated on Government charts by the Maltese Cross symbol for nonprecision approaches and the lightning bolt symbol for precision approaches; or when ATC directs a lower-than-published Glideslope/path Intercept Altitude, it is the resultant actual point of the glideslope/path intercept. (See Final Approach Point, Glideslope/path Intercept Altitude, Segments of an Instrument Approach Procedure)

FINAL APPROACH—IFR— The flight path of an aircraft which is inbound to an airport on a final instrument approach course, beginning at the final approach fix or point and extending to the airport or the point where a circle-to-land maneuver or a missed approach is executed. (See Segments of an Instrument Approach Procedure, Final Approach Fix, Final Approach Course, Final Approach Point)

ICAO—FINAL APPROACH— That part of an instrument approach procedure from the time the aircraft has:

1. Completed the last procedure turn or base turn, where one is specified, or
2. Crossed a specified fix, or
3. Intercepted the last track specified for the procedures until it has crossed a point in the vicinity of an aerodrome from which:
    a. A landing can be made, or
    b. A missed approach procedure is initiated.

FINAL APPROACH POINT/FAP— The point, applicable only to a nonprecision approach with no depicted FAF (such as an on-airport VOR), where the aircraft is established inbound on the final approach course from the procedure turn and where the final approach descent may be commenced. The FAP serves as the FAF and identifies the beginning of the final approach segment. (See Final Approach Fix, Segments of an Instrument Approach Procedure)

FINAL APPROACH SEGMENT— (See Segments of an Instrument Approach Procedure)

FINAL APPROACH—VFR— (See Traffic Pattern)

FINAL CONTROLLER— The controller providing information and final approach guidance during PAR and ASR approaches utilizing radar equipment. (See Radar Approach)

FIX— A geographical position determined by visual reference to the surface, by reference to one or more radio NAVAIDs, by celestial plotting, or by another navigational device.

FLAG/FLAG ALARM— A warning device incorporated in certain airborne navigation and flight instruments indicating that:

1. Instruments are inoperative or otherwise not operating satisfactorily, or
2. Signal strength or quality of the received signal falls below acceptable values.

FLAMEOUT— Unintended loss of combustion in turbine engines resulting in the loss of engine power.

FLIGHT CHECK— A call-sign prefix used by FAA aircraft engaged in flight inspection/certification of navigational aids and flight procedures. The word "recorded" may be added as a suffix; e.g., "Flight Check 320 recorded" to indicate that an automated flight inspection is in progress in terminal areas. (See Flight Inspection/Flight Check) (Refer to AIM).

FLIGHT INFORMATION REGION/FIR— An airspace of defined dimensions within which Flight Information Service and Alerting Service are provided.

1. Flight Information Service—A service provided for the purpose of giving advice and information useful for the safe and efficient conduct of flights.
2. Alerting Service—A service provided to notify appropriate organizations regarding aircraft in need of search and rescue aid and to assist such organizations as required.

FLIGHT INSPECTION/FLIGHT CHECK— Inflight investigation and evaluation of a navigational aid to determine whether it meets established tolerances. (See Navigational Aid)

FLIGHT LEVEL— A level of constant atmospheric pressure related to a reference datum of 29.92 inches of mercury. Each is stated in three digits that represent hundreds of feet. For example, flight level 250 represents a barometric altimeter indication of 25,000 feet; flight level 255, an indication of 25,500 feet.

ICAO—FLIGHT LEVELS—Surfaces of constant atmospheric pressure which are related to a specific pressure datum, 1013.2 mb (29.92 inches) and are separated by specific pressure intervals.

FLIGHT LINE— A term used to describe the precise movement of a civil photogrammetric aircraft along a predetermined course(s) at a predetermined altitude during the actual photographic run.

FLIGHT PATH— A line, course, or track along which an aircraft is flying or intended to be flown. (See Track, Course)

FLIGHT PLAN— Specified information relating to the intended flight of an aircraft that is filed orally or in writing with an FSS or an ATC facility. (See Fast File, Filed) (Refer to AIM)

FLIGHT RECORDER— A general term applied to any instrument or device that records information about the performance of an aircraft in flight or about conditions encountered in flight. Flight recorders may make records of airspeed, outside air temperature, vertical acceleration, engine RPM, manifold pressure, and other pertinent variables for a given flight.

*ICAO—FLIGHT RECORDER—*Any type of recorder installed in the aircraft for the purpose of complementing accident/incident investigation.

FLIGHT SERVICE STATION/FSS— Air traffic facilities which provide pilot briefing, en route communications and VFR search and rescue services, assist lost aircraft and aircraft in emergency situations, relay ATC clearances, originate Notices to Airmen, broadcast aviation weather and NAS information, receive and process IFR flight plans, and monitor NAVAID's. In addition, at selected locations FSS's provide Enroute Flight Advisory Service (Flight Watch), take weather observations, issue airport advisories, and advise Customs and Immigration of transborder flights. (Refer to AIM)

FLIGHT STANDARDS DISTRICT OFFICE/FSDO— An FAA field office serving an assigned geographical area and staffed with Flight Standards personnel who serve the aviation industry and the general public on matters relating to the certification and operation of air carrier and general aviation aircraft. Activities include general surveillance of operational safety, certification of airmen and aircraft, accident prevention, investigation, enforcement, etc.

FLIGHT TEST— A flight for the purpose of:

1. Investigating the operation/flight characteristics of an aircraft or aircraft component.
2. Evaluating an applicant for a pilot certificate or rating.

FLIGHT VISIBILITY— (See Visibility)

FLIGHT WATCH— A shortened term for use in air-ground contacts on frequency 122.0 MHz to identify the flight service station providing En Route Flight Advisory Service; e.g., "Oakland Flight Watch." (See En Route Flight Advisory Service)

FLIP— (See DOD FLIP)

FLOW CONTROL— Measures designed to adjust the flow of traffic into a given airspace, along a given route, or bound for a given aerodrome (airport) so as to ensure the most effective utilization of the airspace. (See Quota Flow Control) (Refer to Airport/Facility Directory

FLY HEADING (DEGREES)— Informs the pilot of the heading he should fly. The pilot may have to turn to, or continue on, a specific compass direction in order to comply with the instructions. The pilot is expected to turn in the shorter direction to the heading unless otherwise instructed by ATC.

FORMATION FLIGHT— More than one aircraft which, by prior arrangement between the pilots, operate as a single aircraft with regard to navigation and position reporting. Separation between aircraft within the formation is the responsibility of the flight leader and the pilots of the other aircraft in the flight. This includes transition periods when aircraft within the formation are maneuvering to attain separation from each other to effect individual control and during join-up and breakaway.

1. A standard formation is one in which a proximity of no more than 1 mile laterally or longitudinally and within 100 feet vertically from the flight leader is maintained by each wingman.
2. Nonstandard formations are those operating under any of the following conditions:
    a. When the flight leader has requested and ATC has approved other than standard formation dimensions.
    b. When operating within an authorized altitude reservation (ALTRV) or under the provisions of a letter of agreement.
    c. When the operations are conducted in airspace specifically designed for a special activity. (See Altitude Reservation) (Refer to FAR Part 91)

FSS— (See Flight Service Station)

FUEL DUMPING— Airborne release of usable fuel. This does not include the dropping of fuel tanks. (See Jettisoning of External Stores)

FUEL SIPHONING/FUEL VENTING— Unintentional release of fuel caused by overflow, puncture, loose cap, etc.

GATE HOLD PROCEDURES— Procedures at selected airports to hold aircraft at the gate or other ground location whenever departure delays exceed or are anticipated to exceed 5 minutes. The sequence for departure will be maintained in accordance with initial call-up unless modified by Flow Control restrictions. Pilots should monitor the ground control/clearance delivery frequency for engine startup advisories or new proposed start time if the delay changes. (See Flow Control)

GENERAL AVIATION— That portion of civil aviation which encompasses all facets of aviation except air carriers holding a certificate of public convenience and necessity from the Civil Aeronautics Board and large aircraft commercial operators.

*ICAO—GENERAL AVIATION—*All civil aviation operations other than scheduled air services and nonscheduled air transport operations for remuneration or hire.

GENERAL AVIATION DISTRICT OFFICE/GADO— An FAA field office serving a designated geographical area and staffed with Flight Standards personnel who have the responsibility for serving the aviation industry and the general public on all matters relating to the certification and operation of general aviation aircraft.

GLIDESLOPE/GLIDEPATH— Provides vertical guidance for aircraft during approach and landing. The glideslope/glidepath is based on the following:

1. Electronic components emitting signals which provide vertical guidance by reference to airborne instruments during instrument approaches such as ILS/MLS, or
2. Visual ground aids, such as VASI, which provide vertical guidance for a VFR approach or for the visual portion of an instrument approach and landing.
3. PAR. Used by ATC to inform an aircraft making a PAR approach of its vertical position (elevation) relative to the descent profile.

ICAO—GLIDEPATH— A descent profile determined for vertical guidance during a final approach.

GLIDESLOPE/GLIDEPATH INTERCEPT ALTITUDE— The minimum altitude to intercept the glideslope/path on a precision approach. The intersection of the published intercept altitude with the glideslope/path, designated on Government charts by the lightning bolt symbol, is the precision FAF; however, when ATC directs a lower altitude, the resultant lower intercept position is then the FAF. (See Final Approach Fix, Segments of an Instrument Approach Procedure)

GO AHEAD— Proceed with your message. Not to be used for any other purpose.

GO AROUND— Instructions for a pilot to abandon his approach to landing. Additional instructions may follow. Unless otherwise advised by ATC, a VFR aircraft or an aircraft conducting visual approach should overfly the runway while climbing to traffic pattern altitude and enter the traffic pattern via the crosswind leg. A pilot on an IFR flight plan making an instrument approach should execute the published missed approach procedure or proceed as instructed by ATC; e.g., "Go around" (additional instructions if required). (See Low Approach, Missed Approach)

GROUND CLUTTER— A pattern produced on the radar scope by ground returns which may degrade other radar returns in the affected area. The effect of ground clutter is minimized by the use of moving target indicator (MTI) circuits in the radar equipment resulting in a radar presentation which displays only targets which are in motion. (See Clutter)

GROUND CONTROLLED APPROACH/GCA— A radar approach system operated from the ground by air traffic control personnel transmitting instructions to the pilot by radio. The approach may be conducted with surveillance radar (ASR) only or with both surveillance and precision approach radar (PAR). Usage of the term "GCA" by pilots is discouraged except when referring to a GCA facility. Pilots should specifically request a "PAR" approach when a precision radar approach is desired or request an "ASR" or "surveillance" approach when a nonprecision radar approach is desired. (See Radar Approach)

GROUND DELAY— The amount of delay attributed to ATC, encountered prior to departure, usually associated with a CDT program.

GROUND SPEED— The speed of an aircraft relative to the surface of the earth.

GROUND VISIBILITY— (See Visibility)

HANDOFF— An action taken to transfer the radar identification of an aircraft from one controller to another if the aircraft will enter the receiving controller's airspace and radio communications with the aircraft will be transferred.

HAVE NUMBERS— Used by pilots to inform ATC that they have received runway, wind, and altimeter information only.

HAZARDOUS INFLIGHT WEATHER ADVISORY SERVICE/HIWAS— A program for broadcasting hazardous weather information (SIGMET's, Convective SIGMET's, CWA's, AIRMET's, and Urgent PIREP's) on a continuous basis over selected VOR's. (Refer to AIM)

HEAVY (AIRCRAFT)— (See Aircraft Classes)

HEIGHT ABOVE AIRPORT/HAA— The height of the Minimum Descent Altitude above the published airport elevation. This is published in conjunction with circling minimums. (See Minimum Descent Altitude)

HEIGHT ABOVE LANDING/HAL— The height above a designated helicopter landing area used for helicopter instrument approach procedures. (Refer to FAR Part 97)

HEIGHT ABOVE TOUCHDOWN/HAT— The height of the Decision Height or Minimum Descent Altitude above the highest runway elevation in the touchdown zone (first 3,000 feet of the runway). HAT is published on instrument approach charts in conjunction with all straight-in minimums. (See Decision Height, Minimum Descent Altitude)

HELICOPTER/COPTER— Rotorcraft that, for its horizontal motion, depends principally on its engine-driven rotors.

*ICAO—HELICOPTER—*A heavier-than-air aircraft supported in flight by the reactions of the air on one or more power-driven rotors on substantially vertical axes.

HELIPAD— A small, designated area, usually with a prepared surface, on a heliport, airport, landing/takeoff area, apron/ramp, or movement area used for takeoff, landing, or parking of helicopters.

HELIPORT— An area of land, water, or structure used or intended to be used for the landing and takeoff of helicopters and includes its buildings and facilities if any.

HERTZ/Hz— The standard radio equivalent of frequency in cycles per second of an electromagnetic wave. Kilohertz (kHz) is a frequency of one thousand cycles per second. Megahertz (MHz) is a frequency of one million cycles per second.

HIGH FREQUENCY/HF— The frequency band between 3 and 30 MHz. (See High Frequency Communications)

HIGH FREQUENCY COMMUNICATIONS/HF COMMUNICATIONS— High radio frequencies (HF) between 3 and 30 MHz used for air-to-ground voice communication in overseas operations.

HIGH SPEED TAXIWAY/EXIT/TURNOFF— A long radius taxiway designed and provided with lighting or marking to define the path of aircraft, traveling at high speed (up to 60 knots), from the runway center to a point on the center of a taxiway. Also referred to as long radius exit or turn-off taxiway. The high speed taxiway is designed to expedite aircraft turning off the runway after landing, thus reducing runway occupancy time.

HOLD/HOLDING PROCEDURE— A predetermined maneuver which keeps aircraft within a specified airspace while awaiting further clearance from air traffic control. Also used during ground operations to keep aircraft within a specified area or at a specified point while awaiting further clearance from air traffic control. (See Holding Fix) (Refer to AIM)

HOLDING FIX— A specified fix identifiable to a pilot by NAVAID's or visual reference to the ground used as a reference point in establishing and maintaining the position of an aircraft while holding. (See Fix, Hold, Visual Holding) (Refer to AIM)

HOLD FOR RELEASE— Used by ATC to delay an aircraft for traffic management reasons; i.e., weather, traffic volume, etc. Hold for release instructions (including departure delay information) are used to inform a pilot or a controller (either directly or through an authorized relay) that a departure clearance is not valid until a release time or additional instructions have been received.

ICAO—HOLDING POINT— A specified location, identified by visual or other means, in the vicinity of which the position of an aircraft in flight is maintained with air traffic control clearances.

HOMING— Flight toward a NAVAID, without correcting for wind, by adjusting the aircraft heading to maintain a relative bearing of zero degrees. (See Bearing)

*ICAO—HOMING—*The procedure of using the direction-finding equipment of one radio station with the emission of another radio station, where at least one of the stations is mobile, and whereby the mobile station proceeds continuously towards the other station.

HOVER CHECK— Used to describe when a helicopter/VTOL aircraft requires a stabilized hover to conduct a performance/power check prior to hover taxi, air taxi, or takeoff. Altitude of the hover will vary based on the purpose of the check.

HOVER TAXI— Used to describe a helicopter/VTOL aircraft movement conducted above the surface and in ground effect at airspeeds less than approximately 20 knots. The actual height may vary, and some helicopters may require hover taxi above 25 feet AGL to reduce ground effect turbulence or provide clearance for cargo slingloads. (See Air Taxi, Hover Check) (Refer to AIM)

HOW DO YOU HEAR ME?— A question relating to the quality of the transmission or to determine how well the transmission is being received.

IDENT— A request for a pilot to activate the aircraft transponder identification feature. This will help the controller to confirm an aircraft identity or to identify an aircraft. (Refer to AIM)

IDENT FEATURE— The special feature in the Air Traffic Control Radar Beacon System (ATCRBS) equipment. It is used to immediately distinguish one displayed beacon target from other beacon targets. (See Ident)

IF FEASIBLE, REDUCE SPEED TO (SPEED)— (See Speed Adjustment)

IF NO TRANSMISSION RECEIVED FOR (TIME)— Used by ATC in radar approaches to prefix procedures which should be followed by the pilot in event of lost communications. (See Lost Communications)

IFR AIRCRAFT/IFR FLIGHT— An aircraft conducting flight in accordance with instrument flight rules.

IFR CONDITIONS— Weather conditions below the minimum for flight under visual flight rules. (See Instrument Meteorological Conditions)

IFR DEPARTURE PROCEDURE— (See IFR Takeoff Minimums and Departure Procedures) (Refer to AIM)

IFR MILITARY TRAINING ROUTES (IR)— Routes used by the Department of Defense and associated Reserve and Air Guard units for the purpose of conducting low-altitude navigation and tactical training in both IFR and VFR weather conditions below 10,000 feet MSL at airspeeds in excess of 250 knots IAS.

IFR TAKEOFF MINIMUMS AND DEPARTURE PROCEDURES— FAR, Part 91, prescribes standard takeoff rules for certain civil users. At some airports, obstructions or other factors require the establishment of nonstandard takeoff minimums, departure procedures, or both to assist pilots in avoiding obstacles during climb to the minimum en route altitude. Those airports are listed in NOS/DOD Instrument Approach Charts (IAP's) under a section entitled "IFR Takeoff Minimums and Departure Procedures." The NOS/DOD IAP chart legend illustrates the symbol used to alert the pilot to nonstandard takeoff minimums and departure procedures. When departing IFR from such airports or from any airports where there are no departure procedures, SID's, or ATC facilities available, pilots should advise ATC of any departure limitations. Controllers may query a pilot to determine acceptable departure directions, turns, or headings after takeoff. Pilots should be familiar with the departure procedures and must assure that their aircraft can meet or exceed any specified climb gradients.

ILS CATEGORIES—

1. ILS Category I—An ILS approach procedure which provides for approach to a height above touchdown of not less than 200 feet and with runway visual range of not less than 1,800 feet.

2. ILS Category II—An ILS approach procedure which provides for approach to a height above touchdown of not less than 100 feet and with runway visual range of not less than 1,200 feet.

3. ILS Category III.

   a. IIIA—An ILS approach procedure which provides for approach without a decision height minimum and with runway visual range of not less than 700 feet.

   b. IIIB—An ILS approach procedure which provides for approach without a decision height minimum and with runway visual range of not less than 150 feet.

   c. IIIC—An ILS approach procedure which provides for approach without a decision height minimum and without runway visual range minimum.

IMMEDIATELY— Used by ATC when such action compliance is required to avoid an imminent situation.

INCREASE SPEED TO (SPEED)— (See Speed Adjustment)

INFORMATION REQUEST/INREQ— A request originated by an FSS for information concerning an overdue VFR aircraft.

INITIAL APPROACH FIX/IAF— The fixes depicted on instrument approach procedure charts that identify the beginning of the initial approach segment(s). (See Fix, Segments of an Instrument Approach Procedure)

INITIAL APPROACH SEGMENT— (See Segments of an Instrument Approach Procedure)

INNER MARKER/IM/INNER MARKER BEACON— A marker beacon used with an ILS (CAT II) precision approach located between the middle marker and the end of the ILS runway, transmitting a radiation pattern keyed at six dots per second and indicating to the pilot, both aurally and visually, that he is at the designated decision height (DH), normally 100 feet above the touchdown zone elevation, on the ILS CAT II approach. It also marks progress during a CAT III approach. (See Instrument Landing System) (Refer to AIM)

INSTRUMENT APPROACH PROCEDURE/IAP/INSTRUMENT APPROACH— A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing or to a point from which a landing may be made visually. It is prescribed and approved for a specific airport by competent authority. (See Segments of an Instrument Approach Procedure) (Refer to FAR, Part 91, AIM)

1. U. S. civil standard instrument approach procedures are approved by the FAA as prescribed under FAR, Part 97 and are available for public use.

2. U.S. military standard instrument approach procedures are approved and published by the Department of Defense.

3. Special instrument approach procedures are approved by the FAA for individual operators but are not published in FAR, Part 97 for public use.

ICAO—INSTRUMENT APPROACH PROCEDURE— A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing, or to a point from which a landing may be made visually.

INSTRUMENT FLIGHT RULES/IFR— Rules governing the procedures for conducting instrument flight. Also a term used by pilots and controllers to indicate type of flight plan. (See Visual Flight Rules, Instrument Meteorological Conditions, Visual Meteorological Conditions) (Refer to AIM)

ICAO—INSTRUMENT FLIGHT RULES—A set of rules governing the conduct of flight under instrument meteorological conditions.

INSTRUMENT LANDING SYSTEM/ILS— A precision instrument approach system which normally consists of the following electronic components and visual aids:

1. Localizer. (See Localizer)

2. Glideslope. (See Glideslope)

3. Outer Marker. (See Outer Marker)

4. Middle Marker. (See Middle Marker)

5. Approach Lights. (See Airport Lighting)

(Refer to FAR Part 91, AIM)

INSTRUMENT METEOROLOGICAL CONDITIONS/IMC— Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling less than the minima specified for visual meteorological conditions. (See Visual Meteorological Conditions, Instrument Flight Rules, Visual Flight Rules)

INSTRUMENT RUNWAY— A runway equipped with electronic and visual navigation aids for which a precision or nonprecision approach procedure having straight-in landing minimums has been approved.

ICAO—INSTRUMENT RUNWAY—A runway intended for the operation of aircraft using nonvisual aids and comprising:

1. Instrument Approach Runway—An instrument runway served by a nonvisual aid providing at least directional guidance adequate for a straight-in approach.

2. Precision Approach Runway, Category I—An instrument runway served by ILS or GCA approach aids and visual aids intended for operations down to 60 metres (200 feet) decision height and down to an RVR of the order of 800 metres (2,600 feet.)

3. Precision Approach Runway, Category II—An instrument runway served by ILS and visual aids intended for operations down to 30 metres (100 feet) decision height and down to an RVR of the order of 400 metres (1,200 feet.)

4. Precision Approach Runway, Category III—An instrument runway served by ILS (no decision height being applicable) and:
    a. By visual aids intended for operations down to an RVR of the order of 200 metres (700 feet);
    b. By visual aids intended for operations down to an RVR of the order of 50 metres (150 feet);
    c. Intended for operations without reliance on external visual reference.

INTERMEDIATE APPROACH SEGMENT— (See Segments of an Instrument Approach Procedure)

INTERMEDIATE FIX/IF— The fix that identifies the beginning of the intermediate approach segment of an instrument approach procedure. The fix is not normally identified on the instrument approach chart as an intermediate fix (IF). (See Segments of an Instrument Approach Procedure)

INTERNATIONAL AIRPORT— Relating to international flight, it means:

1. An airport of entry which has been designated by the Secretary of Treasury or Commissioner of Customs as an international airport for customs service.
2. A landing rights airport at which specific permission to land must be obtained from customs authorities in advance of contemplated use.
3. Airports designated under the Convention on International Civil Aviation as an airport for use by international commercial air transport and/or international general aviation. (Refer to Airport/Facility Directory and IFIM).

ICAO—INTERNATIONAL AIRPORT—Any airport designated by the Contracting State in whose territory it is situated as an airport of entry and departure for international air traffic, where the formalities incident to customs, immigration, public health, animal and plant quarantine, and similar procedures are carried out.

INTERNATIONAL CIVIL AVIATION ORGANIZATION/ICAO— A specialized agency of the United Nations whose objective is to develop the principles and techniques of international air navigation and to foster planning and development of international civil air transport.

INTERNATIONAL FLIGHT INFORMATION MANUAL/IFIM— A publication designed primarily as a pilot's preflight planning guide for flights into foreign airspace and for flights returning to the U.S. from foreign locations.

INTERROGATOR— The ground-based surveillance radar beacon transmitter-receiver, which normally scans in synchronism with a primary radar, transmitting discrete radio signals which repetitiously request all transponders on the mode being used to reply. The replies received are mixed with the primary radar returns and displayed on the same plan position indicator (radar scope). Also, applied to the airborne element of the TACAN/DME system. (See Transponder) (Refer to AIM)

INTERSECTING RUNWAYS— Two or more runways which cross or meet within their lengths. (See Intersection)

INTERSECTION—

1. A point defined by any combination of courses, radials, or bearings of two or more navigational aids.
2. Used to describe the point where two runways, a runway and a taxiway, or two taxiways cross or meet.

INTERSECTION DEPARTURE/INTERSECTION TAKEOFF— A takeoff or proposed takeoff on a runway from an intersection. (See Intersection)

I SAY AGAIN— The message will be repeated.

JAMMING— Electronic or mechanical interference which may disrupt the display of aircraft on radar or the transmission/reception of radio communications/navigation.

JET BLAST— Jet engine exhaust (thrust stream turbulence). (See Wake Turbulence)

JET ROUTE— A route designed to serve aircraft operations from 18,000 feet MSL up to and including flight level 450. The routes are referred to as "J" routes with numbering to identify the designated route; e.g., J105. (See Route) (Refer to FAR Part 71)

JET STREAM— A migrating stream of high-speed winds present at high altitudes.

JETTISONING OF EXTERNAL STORES— Airborne release of external stores; e.g., tiptanks, ordnance. (See Fuel Dumping) (Refer to FAR Part 91)

JOINT USE RESTRICTED AREA— (See Restricted Area)

KNOWN TRAFFIC— With respect to ATC clearances, means aircraft whose altitude, position, and intentions are known to ATC.

LANDING/TAKEOFF AREA— Any locality either on land, water, or structures, including airports/heliports and intermediate landing fields, which is used, or intended to be used, for the landing and takeoff of aircraft whether or not facilities are provided for the shelter, servicing, or for receiving or discharging passengers or cargo.

ICAO—LANDING AREA—That part of the movement area intended for the landing and takeoff of aircraft.

LANDING DIRECTION INDICATOR— A device which visually indicates the direction in which landings and takeoffs should be made. (See Tetrahedron) (Refer to AIM)

LANDING MINIMUMS/IFR LANDING MINIMUMS— The minimum visibility prescribed for landing a civil aircraft while using an instrument approach procedure. The minimum applies with other limitations set forth in FAR Part 91 with respect to the Minimum Descent Altitude (MDA) or Decision Height (DH) prescribed in the instrument approach procedures as follows:

1. Straight-in landing minimums—A statement of MDA and visibility, or DH and visibility, required for a straight-in landing on a specified runway, or
2. Circling minimums— A statement of MDA and visibility required for the circle-to-land maneuver.

Descent below the established MDA or DH is not authorized during an approach unless the aircraft is in a position from which a normal approach to the runway of intended landing can be made and adequate visual reference to required visual cues is maintained. (See Straight-in Landing, Circle-to-Land Maneuver, Decision Height, Minimum Descent Altitude, Visibility, Instrument Approach Procedure) (Refer to FAR Part 91)

LANDING ROLL— The distance from the point of touchdown to the point where the aircraft can be brought to a stop or exit the runway.

LANDING SEQUENCE— The order in which aircraft are positioned for landing. (See Approach Sequence)

LAST ASSIGNED ALTITUDE— The last altitude/flight level assigned by ATC and acknowledged by the pilot. (See Maintain) (Refer to FAR Part 91)

LATERAL SEPARATION— The lateral spacing of aircraft at the same altitude by requiring operation on different routes or in different geographical locations. (See Separation)

LIGHTED AIRPORT— An airport where runway and obstruction lighting is available. (See Airport Lighting) (Refer to AIM)

LIGHT GUN— A handheld directional light signaling device which emits a brilliant narrow beam of white, green, or red light as selected by the tower controller. The color and type of light transmitted can be used to approve or disapprove anticipated pilot actions where radio communication is not available. The light gun is used for controlling traffic operating in the vicinity of the airport and on the airport movement area. (Refer to AIM)

LOCALIZER— The component of an ILS which provides course guidance to the runway. (See Instrument Landing System) (Refer to AIM)

ICAO—LOCALIZER COURSE (ILS)— The locus of points, in any given horizontal plane, at which the DDM (difference in depth of modulation) is zero.

LOCALIZER TYPE DIRECTIONAL AID/LDA— A NAVAID used for nonprecision instrument approaches with utility and accuracy comparable to a localizer but which is not a part of a complete ILS and is not aligned with the runway. (Refer to AIM)

LOCALIZER USABLE DISTANCE— The maximum distance from the localizer transmitter at a specified altitude, as verified by flight inspection, at which reliable course information is continuously received. (Refer to AIM)

LOCAL TRAFFIC— Aircraft operating in the traffic pattern or within sight of the tower, or aircraft known to be departing or arriving from flight in local practice areas, or aircraft executing practice instrument approaches at the airport. (See Traffic Pattern)

LONGITUDINAL SEPARATION— The longitudinal spacing of aircraft at the same altitude by a minimum distance expressed in units of time or miles. (See Separation) (Refer to AIM)

LORAN/LONG RANGE NAVIGATION— An electronic navigational system by which hyperbolic lines of position are determined by measuring the difference in the time of reception of synchronized pulse signals from two fixed transmitters. Loran A operates in the 1750—1950 kHz frequency band. Loran C and D operate in the 100—110 kHz frequency band. (Refer to AIM)

LOST COMMUNICATIONS/TWO-WAY RADIO COMMUNICATIONS FAILURE— Loss of the ability to communicate by radio. Aircraft are sometimes referred to as NORDO (No Radio). Standard pilot procedures are specified in FAR Part 91. Radar controllers issue procedures for pilots to follow in the event of lost communications during a radar approach when weather reports indicate that an aircraft will likely encounter IFR weather conditions during the approach. (Refer to FAR Part 91, AIM)

LOW ALTITUDE AIRWAY STRUCTURE/FEDERAL AIRWAYS— The network of airways serving aircraft operations up to but not including 18,000 feet MSL. (See Airway) (Refer to AIM)

LOW ALTITUDE ALERT, CHECK YOUR ALTITUDE IMMEDIATELY— (See Safety Alert)

LOW ALTITUDE ALERT SYSTEM/LAAS— An automated function of the TPX-42 that alerts the controller when a Mode C transponder-equipped aircraft on an IFR flight plan is below a predetermined minimum safe altitude. If requested by the pilot, LAAS monitoring is also available to VFR Mode C transponder-equipped aircraft.

LOW APPROACH— An approach over an airport or runway following an instrument approach or a VFR approach including the go-around maneuver where the pilot intentionally does not make contact with the runway. (Refer to AIM)

LOW FREQUENCY/LF— The frequency band between 30 and 300 kHz. (Refer to AIM)

MACH NUMBER— The ratio of true airspeed to the speed of sound; e.g., MACH .82, MACH 1.6. (See Airspeed)

MAINTAIN—

1. Concerning altitude/flight level, the term means to remain at the altitude/flight level specified. The phrase "climb and" or "descend and" normally precedes "maintain" and the altitude assignment; e.g., "descend and maintain 5,000."
2. Concerning other ATC instructions, the term is used in its literal sense; e.g., maintain VFR.

MAKE SHORT APPROACH— Used by ATC to inform a pilot to alter his traffic pattern so as to make a short final approach. (See Traffic Pattern)

MANDATORY ALTITUDE— An altitude depicted on an instrument Approach Procedure Chart requiring the aircraft to maintain altitude at the depicted value.

MARKER BEACON— An electronic navigation facility transmitting a 75 MHz vertical fan or boneshaped radiation pattern. Marker beacons are identified by their modulation frequency and keying code, and when received by compatible airborne equipment, indicate to the pilot, both aurally and visually, that he is passing over the facility. (See Outer Marker, Middle Marker, Inner Marker) (Refer to AIM)

MAXIMUM AUTHORIZED ALTITUDE/MAA— A published altitude representing the maximum usable altitude or flight level for an airspace structure or route segment. It is the highest altitude on a Federal airway, jet route, area navigation low or high route, or other direct route for which an MEA is designated in FAR Part 95 at which adequate reception of navigation aid signals is assured.

MAYDAY— The international radiotelephony distress signal. When repeated three times, it indicates imminent and grave danger and that immediate assistance is requested. (See Pan-Pan) (Refer to AIM)

METEOROLOGICAL IMPACT STATEMENT/MIS— An unscheduled planning forecast describing conditions expected to begin within 4 to 12 hours which may impact the flow of air traffic in a specific center's (ARTCC) area.

METERING— A method of time-regulating arrival traffic flow into a terminal area so as not to exceed a predetermined terminal acceptance rate.

METERING FIX— A fix along an established route from over which aircraft will be metered prior to entering terminal airspace. Normally, this fix should be established at a distance from the airport which will facilitate a profile descent 10,000 feet above airport elevation (AAE) or above.

MIA— (See Minimum IFR Altitudes)

MICROWAVE LANDING SYSTEM/MLS— A precision instrument approach system operating in the microwave spectrum which normally consists of the following components:

1. Azimuth Station.
2. Elevation Station.
3. Precision Distance Measuring Equipment. (See MLS Categories)

MIDDLE COMPASS LOCATOR— (See Compass Locator)

MIDDLE MARKER/MM— A marker beacon that defines a point along the glide slope of an ILS normally located at or near the point of decision height (ILS Category I). It is keyed to transmit alternate dots and dashes, with the alternate dots and dashes keyed at the rate of 95 dot/dash combinations per minute on a 1300 Hz tone, which is received aurally and visually by compatible airborne equipment. (See Marker Beacon, Instrument Landing System) (Refer to AIM)

MID RVR— (See Visibility)

MILITARY AUTHORITY ASSUMES RESPONSIBILITY FOR SEPARATION OF AIRCRAFT/MARSA— A condition whereby the military services involved assume responsibility for separation between participating military aircraft in the ATC system. It is used only for required IFR operations which are specified in letters of agreement or other appropriate FAA or military documents.

MILITARY OPERATIONS AREA/MOA— (See Special Use Airspace)

MILITARY TRAINING ROUTES/MTR— Airspace of defined vertical and lateral dimensions established for the conduct of military flight training at airspeeds in excess of 250 knots IAS. (See IFR (IR) and VFR (VR) Military Training Routes)

MINIMUM CROSSING ALTITUDE/MCA— The lowest altitude at certain fixes at which an aircraft must cross when proceeding in the direction of a higher minimum en route IFR altitude (MEA). (See Minimum En Route IFR Altitude)

MINIMUM DESCENT ALTITUDE/MDA— The lowest altitude, expressed in feet above mean sea level, to which descent is authorized on final approach or during circle-to-land maneuvering in execution of a standard instrument approach procedure where no electronic glide slope is provided. (See Nonprecision Approach Procedure)

MINIMUM EN ROUTE IFR ALTITUDE/MEA— The lowest published altitude between radio fixes which assures acceptable navigational signal coverage and meets obstacle clearance requirements between those fixes. The MEA prescribed for a Federal airway or segment thereof, area navigation low or high route, or other direct route applies to the entire width of the airway, segment, or route between the radio fixes defining the airway, segment, or route. (Refer to FAR Parts 91 and 95; AIM)

MINIMUM FUEL— Indicates that an aircraft's fuel supply has reached a state where, upon reaching the destination, it can accept little or no delay. This is not an emergency situation but merely indicates an emergency situation is possible should any undue delay occur. (Refer to AIM)

MINIMUM HOLDING ALTITUDE/MHA— The lowest altitude prescribed for a holding pattern which assures navigational signal coverage, communications, and meets obstacle clearance requirements.

MINIMUM IFR ALTITUDES/MIA— Minimum altitudes for IFR operations as prescribed in FAR Part 91. These altitudes are published on aeronautical charts and prescribed in FAR Part 95 for airways and routes, and in FAR Part 97 for standard instrument approach procedures. If no applicable minimum altitude is prescribed in FAR Parts 95 or 97, the following minimum IFR altitude applies:

1. In designated mountainous areas, 2,000 feet above the highest obstacle within a horizontal

distance of 5 statute miles from the course to be flown; or

2. Other than mountainous areas, 1,000 feet above the highest obstacle within a horizontal distance of 5 statute miles from the course to be flown; or
3. As otherwise authorized by the Administrator or assigned by ATC. (See Minimum En Route IFR Altitude, Minimum Obstruction Clearance Altitude, Minimum Crossing Altitude, Minimum Safe Altitude, Minimum Vectoring Altitude) (Refer to FAR Part 91)

MINIMUM OBSTRUCTION CLEARANCE ALTITUDE/MOCA— The lowest published altitude in effect between radio fixes on VOR airways, off-airway routes, or route segments which meets obstacle clearance requirements for the entire route segment and which assures acceptable navigational signal coverage only within 25 statute (22 nautical) miles of a VOR. (Refer to FAR Part 91 and 95)

MINIMUM RECEPTION ALTITUDE/MRA— The lowest altitude at which an intersection can be determined. (Refer to FAR Part 95)

MINIMUM SAFE ALTITUDE/MSA—

1. The minimum altitude specified in FAR Part 91 for various aircraft operations.
2. Altitudes depicted on approach charts which provide at least 1,000 feet of obstacle clearance for emergency use within a specified distance from the navigation facility upon which a procedure is predicated. These altitudes will be identified as Minimum Sector Altitudes or Emergency Safe Altitudes and are established as follows:
    a. Minimum Sector Altitudes—Altitudes depicted on approach charts which provide at least 1,000 feet of obstacle clearance within a 25-mile radius of the navigation facility upon which the procedure is predicated. Sectors depicted on approach charts must be at least 90 degrees in scope. These altitudes are for emergency use only and do not necessarily assure acceptable navigational signal coverage.

ICAO—MINIMUM SECTOR ALTITUDE— The lowest altitude which may be used under emergency conditions which will provide a minimum clearance of 300 meters (1,000 feet) above all obstacles located in an area contained within a sector of a circle of 25 nautical mile radius centered on a radio aid to navigation.

    b. Emergency Safe Altitudes—Altitudes depicted on approach charts which provide at least 1,000 feet of obstacle clearance in nonmountainous areas and 2,000 feet of obstacle clearance in designated mountainous areas within a 100-mile radius of the navigation facility upon which the procedure is predicated and normally used only in military procedures. These altitudes are identified on published procedures as "Emergency Safe Altitudes."

MINIMUM SAFE ALTITUDE WARNING (MSAW)— A function of the ARTS III computer that aids the controller by alerting him when a tracked Mode C-equipped aircraft is below or is predicted by the computer to go below a predetermined minimum safe altitude. (Refer to AIM)

MINIMUMS/MINIMA— Weather condition requirements established for a particular operation or type of operation; e.g., IFR takeoff or landing, alternate airport for IFR flight plans, VFR flight, etc. (See Landing Minimums, IFR Takeoff Minimums, VFR Conditions, IFR Conditions) (Refer to FAR Part 91, AIM)

MINIMUM VECTORING ALTITUDE/MVA— The lowest MSL altitude at which an IFR aircraft will be vectored by a radar controller, except as otherwise authorized for radar approaches, departures, and missed approaches. The altitude meets IFR obstacle clearance criteria. It may be lower than the published MEA along an airway or J-route segment. It may be utilized for radar vectoring only upon the controller's determination that an adequate radar return is being received from the aircraft being controlled. Charts depicting minimum vectoring altitudes are normally available only to the controllers and not to pilots. (Refer to AIM)

MISSED APPROACH—

1. A maneuver conducted by a pilot when an instrument approach cannot be completed to a landing. The route of flight and altitude are shown on instrument approach procedure charts. A pilot executing a missed approach prior to the Missed Approach Point (MAP) must continue along the final approach to the MAP. The pilot may climb immediately to the altitude specified in the missed approach procedure.
2. A term used by the pilot to inform ATC that he is executing the missed approach.
3. At locations where ATC radar service is provided, the pilot should conform to radar vectors when provided by ATC in lieu of the published missed approach procedure. (See Missed Approach Point) (Refer to AIM)

ICAO—MISSED APPROACH PROCEDURE— The procedure to be followed if, after an instrument approach, a landing is not effected, and occuring normally.

1. When the aircraft has descended to the decision height and has not established visual contact, or
2. When directed by air traffic control to pull up or to go around again.

MISSED APPROACH POINT/MAP— A point prescribed in each instrument approach procedure at which a missed approach procedure shall be executed if the required visual reference does not exist. (See Missed Approach, Segments of an Instrument Approach Procedure)

MISSED APPROACH SEGMENT— (See Segments of an Instrument Approach Procedure)

MLS—(See Microwave Landing System)

MLS CATEGORIES—

1. MLS Category I—An MLS approach procedure which provides for an approach to a height above touchdown of not less than 200 feet and a runway visual range of not less than 1,800 feet.
2. MLS Category II—Undefined until data gathering/analysis completion.
3. MLS Category III—Undefined until data gathering/analysis completion.

MODE— The letter or number assigned to a specific pulse spacing of radio signals transmitted or received by ground interrogator or airborne transponder components of the Air Traffic Control Radar Beacon System (ATCRBS). Mode A (military Mode 3) and Mode C (altitude reporting) are used in air traffic control. (See Transponder, Interrogator, Radar) (Refer to AIM)

ICAO—MODE (SSR MODE)— The letter or number assigned to a specific pulse spacing of the interrogation signals transmitted by an interrogator. There are 4 modes, A, B, C and D corresponding to four different interrogation pulse spacings.

MOVEMENT AREA— The runways, taxiways, and other areas of an airport/heliport which are utilized for taxiing/hover taxiing, air taxiing, takeoff, and landing of aircraft, exclusive of loading ramps and parking areas. At those airports/heliports with a tower, specific approval for entry onto the movement area must be obtained from ATC.

ICAO—MOVEMENT AREA— That part of an aerodrome intended for the surface movement of aircraft, including the maneuvering area and aprons.

MOVING TARGET INDICATOR/MTI— An electronic device which will permit radar scope presentation only from targets which are in motion. A partial remedy for ground clutter.

MSAW— (See Minimum Safe Altitude Warning)

MULTICOM— A mobile service not open to public correspondence used to provide communications essential to conduct the activities being performed by or directed from private aircraft (FAR 87.277).

NAS STAGE A— The en route ATC system's radar, computers and computer programs, controller plan view displays (PVDs/Radar Scopes), input/output devices, and the related communications equipment which are integrated to form the heart of the automated IFR air traffic control system. This equipment performs Flight Data Processing (FDP) and Radar Data Processing (RDP). It interfaces with automated terminal systems and is used in the control of en route IFR aircraft. (Refer to AIM)

NATIONAL AIRSPACE SYSTEM/NAS— The common network of U.S. airspace; air navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information and services; rules, regulations and procedures, technical information, and manpower and material. Included are system components shared jointly with the military.

NATIONAL BEACON CODE ALLOCATION PLAN AIRSPACE/NBCAP AIRSPACE— Airspace over United States territory located within the North American continent between Canada and Mexico, including adjacent territorial waters outward to about boundaries of oceanic control areas (CTA)/Flight Information Regions (FIR). (See Flight Information Region)

NATIONAL FLIGHT DATA CENTER/NFDC— A facility in Washington D.C., established by FAA to operate a central aeronautical information service for the collection, validation, and dissemination of aeronautical data in support of the activities of government, industry, and the aviation community. The information is published in the National Flight Data Digest. (See National Flight Data Digest)

NATIONAL FLIGHT DATA DIGEST/NFDD— A daily (except weekends and Federal holidays) publication of flight information appropriate to aeronautical charts, aeronautical publications, Notices to Airmen, or other media serving the purpose of providing operational flight data essential to safe and efficient aircraft operations.

NATIONAL SEARCH AND RESCUE PLAN— An interagency agreement which provides for the effective utilization of all available facilities in all types of search and rescue missions.

NAVAID CLASSES— VOR, VORTAC, and TACAN aids are classed according to their operational use. The three classes of NAVAID's are:

T—Terminal.

L—Low altitude.

H—High altitude.

The normal service range for T, L, and H class aids is found in the AIM. Certain operational requirements make it necessary to use some of these aids at greater service ranges than specified. Extended range is made possible through flight inspection determinations. Some aids also have lesser service range due to location, terrain, frequency protection, etc. Restrictions to service range are listed in Airport/Facility Directory.

NAVIGABLE AIRSPACE— Airspace at and above the minimum flight altitudes prescribed in the FAR's including airspace needed for safe takeoff and landing. (Refer to FAR Part 91)

NAVIGATIONAL AID/NAVAID— Any visual or electronic device airborne or on the surface which provides point-to- point guidance information or position data to aircraft in flight. (See Air Navigation Facility)

NDB— (See Nondirectional Beacon)

NEGATIVE— "No," or "permission not granted," or "that is not correct."

NEGATIVE CONTACT— Used by pilots to inform ATC that:

1. Previously issued traffic is not in sight. It may be followed by the pilot's request for the controller to provide assistance in avoiding the traffic.
2. They were unable to contact ATC on a particular frequency.

NIGHT— The time between the end of evening civil twilight and the beginning of morning civil twilight, as published in the American Air Almanac, converted to local time.

ICAO—NIGHT— The hours between the end of evening civil twilight and the beginning of morning civil twilight or such other period between sunset and sunrise as may be specified by the appropriate authority.

NO GYRO APPROACH/VECTOR— A radar approach/vector provided in case of a malfunctioning gyro-compass or directional gyro. Instead of providing the pilot with headings to be flown, the controller observes the radar track and issues control instructions "turn right/left" or "stop turn" as appropriate. (Refer to AIM)

NONAPPROACH CONTROL TOWER— Authorizes aircraft to land or takeoff at the airport controlled by the tower or to transit the airport traffic area. The primary function of a nonapproach control tower is the sequencing of aircraft in the traffic pattern and on the landing area. Nonapproach control towers also separate aircraft operating under instrument flight rules clearances from approach controls and centers. They provide ground control services to aircraft, vehicles, personnel, and equipment on the airport movement area.

NONCOMPOSITE SEPARATION— Separation in accordance with minima other than the composite separation minimum specified for the area concerned.

NONDIRECTIONAL BEACON/RADIO BEACON/NDB— An L/MF or UHF radio beacon transmitting nondirectional signals whereby the pilot of an aircraft equipped with direction finding equipment can determine his bearing to or from the radio beacon and "home" on or track to or from the station. When the radio beacon is installed in conjunction with the Instrument Landing System marker, it is normally called a Compass Locator. (See Compass Locator, Automatic Direction Finder)

NONPRECISION APPROACH PROCEDURE/NONPRECISION APPROACH— A standard instrument approach procedure in which no electronic glide slope is provided; e.g., VOR, TACAN, NDB, LOC, ASR, LDA, or SDF approaches.

NONRADAR— Precedes other terms and generally means without the use of radar, such as:

1. Nonradar Route—A flight path or route over which the pilot is performing his own navigation. The pilot may be receiving radar separation, radar monitoring, or other ATC services while on a nonradar route. (See Radar Route)

2. Nonradar Approach—Used to describe instrument approaches for which course guidance on final approach is not provided by ground- based precision or surveillance radar. Radar vectors to the final approach course may or may not be provided by ATC. Examples of nonradar approaches are VOR, NDB, TACAN, and ILS/MLS approaches. (See Final Approach—IFR, Final Approach Course, Radar Approach, Instrument Approach Procedure)

3. Nonradar Separation—The spacing of aircraft in accordance with established minima without the use of radar; e.g., vertical, lateral, or longitudinal separation. (See Radar Separation)

ICAO—NonRadar Separation— The separation used when aircraft position information is derived from sources other than radar.

4. Nonradar Arrival—An arriving aircraft that is not being vectored to the final approach course for an instrument approach or towards the airport for a visual approach. The aircraft may or may not be in a radar environment and may or may not be receiving radar separation, radar monitoring, or other services provided by ATC. (See Radar Arrival, Radar Environment)

NONRADAR APPROACH CONTROL— An ATC facility providing approach control service without the use of radar. (See Approach Control, Approach Control Service)

NORDO— (See Lost Communications)

NORTH AMERICAN ROUTE— A numerically coded route preplanned over existing airway and route systems to and from specific coastal fixes serving the North Atlantic. North American Routes consist of the following:

1. Common Route/Portion—That segment of a North American Route between the inland navigation facility and the coastal fix.

2. Non-Common Route/Portion—That segment of a North American Route between the inland navigation facility and a designated North American terminal.

3. Inland Navigation Facility—A navigation aid on a North American Route at which the common route and/or the non-common route begins or ends.

4. Coastal Fix—A navigation aid or intersection where an aircraft transitions between the domestic route structure and the oceanic route structure.

NOTICES TO AIRMEN PUBLICATION— A publication designed primarily as a pilot's operational manual containing current NOTAM information considered essential to the safety of flight as well as supplemental data to other aeronautical publications. (See Notice to Airmen/NOTAM)

NOTICE TO AIRMEN/NOTAM— A notice containing information (not known sufficiently in advance to publicize by other means) concerning the establishment, condition, or change in any component (facility, service, or procedure of, or hazard in the National Airspace System) the timely knowledge of which is essential to personnel concerned with flight operations.

1. NOTAM(D)—A NOTAM given (in addition to local dissemination) distant dissemination via teletypewriter beyond the area of responsibility of the Flight Service Station. These NOTAM's will be stored and repeated hourly until canceled.

2. NOTAM(L)—A NOTAM given local dissemination by voice (teletypewriter where applicable) and a wide variety of means, such as telautograph, teleprinter, facsimile reproduction, hot line, telecopier, telegraph, and telephone, to satisfy local user requirements.

3. FDC NOTAM—A notice to airmen, regulatory in nature, transmitted by NFDC and given all-circuit dissemination.

ICAO—NOTAM— A notice, containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations.

NUMEROUS TARGETS VICINITY (LOCATION)— A traffic advisory issued by ATC to advise pilots that targets on the radar scope are too numerous to issue individually. (See Traffic Advisories)

OBSTACLE— An existing object, object of natural growth, or terrain at a fixed geographical location or which may be expected at a fixed location within a prescribed area with reference to which vertical clearance is or must be provided during flight operation.

OBSTRUCTION— Any object/obstacle exceeding the obstruction standards specified by FAR Part 77, Subpart C.

OBSTRUCTION LIGHT— A light or one of a group of lights, usually red or white, frequently mounted on a surface structure or natural terrain to warn pilots of the presence of an obstruction.

OFF-ROUTE VECTOR— A vector by ATC which takes an aircraft off a previously assigned route. Altitudes assigned by ATC during such vectors provide required obstacle clearance.

OFFSET PARALLEL RUNWAYS— Staggered runways having centerlines which are parallel.

ON COURSE—

1. Used to indicate that an aircraft is established on the route centerline.
2. Used by ATC to advise a pilot making a radar approach that his aircraft is lined up on the final approach course. (See On-Course Indication)

ON-COURSE INDICATION— An indication on an instrument, which provides the pilot a visual means of determining that the aircraft is located on the centerline of a given navigational track, or an indication on a radar scope that an aircraft is on a given track.

OPTION APPROACH— An approach requested and conducted by a pilot which will result in either a touch-and-go, missed approach, low approach, stop-and-go, or full stop landing. (See Cleared for the Option) (Refer to AIM)

ORGANIZED TRACK SYSTEM— A moveable system of oceanic tracks that traverses the North Atlantic between Europe and North America the physical position of which is determined twice daily taking the best advantage of the winds aloft.

OUT— The conversation is ended and no response is expected.

OUTER AREA (associated with ARSA)— Nonregulatory airspace surrounding designated ARSA airports wherein ATC provides radar vectoring and sequencing on a full-time basis for all IFR and participating VFR aircraft. The service provided in the outer area is called ARSA service which includes: IFR/IFR—standard IFR separation; IFR/VFR—traffic advisories and conflict resolution; and VFR/VFR—traffic advisories and, as appropriate, safety alerts. The normal radius will be 20 nautical miles with some variations based on site-specific requirements. The outer area extends outward from the primary ARSA airport and extends from the lower limits of radar/radio coverage up to the ceiling of the approach control's delegated airspace excluding the ARSA and other airspace as appropriate. (See Controlled Airspace—Airport Radar Service Area / ARSA, Conflict Resolution)

OUTER COMPASS LOCATOR— (See Compass Locator)

OUTER FIX— A general term used within ATC to describe fixes in the terminal area, other than the final approach fix. Aircraft are normally cleared to these fixes by an Air Route Traffic Control Center or an Approach Control Facility. Aircraft are normally cleared from these fixes to the final approach fix or final approach course.

OUTER MARKER/OM— A marker beacon at or near the glide slope intercept altitude of an ILS approach. It is keyed to transmit two dashes per second on a 400 Hz tone, which is received aurally and visually by compatible airborne equipment. The OM is normally located four to seven miles from the runway threshold on the extended centerline of the runway. (See Marker Beacon, Instrument Landing System) (Refer to AIM)

OVER— My transmission is ended; I expect a response.

OVERHEAD APPROACH/360 OVERHEAD— A series of predetermined maneuvers prescribed for VFR arrival of military aircraft (often in formation) for entry into the VFR traffic pattern and to proceed to a landing. The pattern usually specifies the following:

1. The radio contact required of the pilot.
2. The speed to be maintained.
3. An initial approach 3 to 5 miles in length.
4. An elliptical pattern consisting of two 180 degree turns.
5. A break point at which the first 180 degree turn is started.
6. The direction of turns.
7. Altitude (at least 500 feet above the conventional pattern).
8. A "Roll-out" on final approach not less than 1/4 mile from the landing threshold and not less than 300 feet above the ground.

PAN-PAN— The international radio-telephony urgency signal. When repeated three times, indicates uncertainty or alert followed by nature of urgency. (See MAYDAY) (Refer to AIM)

PARALLEL ILS/MLS APPROACHES— Approaches to parallel runways by IFR aircraft which, when established inbound toward the airport on the adjacent final approach courses, are radar-separated by at least 2 miles. (See Final Approach Course, Simultaneous ILS/MLS Approaches).

PARALLEL OFFSET ROUTE— A parallel track to the left or right of the designated or established airway/route. Normally associated with Area Navigation (RNAV) operations. (See Area Navigation)

PARALLEL RUNWAYS— Two or more runways at the same airport whose centerlines are parallel. In addition to runway number, parallel runways are designated as L (left) and R (right) or, if three parallel runways exist, L (left), C (center), and R (right).

PERMANENT ECHO— Radar signals reflected from fixed objects on the earth's surface; e.g., buildings, towers, terrain. Permanent echoes are distinguished from "ground clutter' by being definable locations rather than large areas. Under certain conditions they may be used to check radar alignment.

PHOTO RECONNAISSANCE (PR)— Military activity that requires locating individual photo targets and navigating to the targets at a preplanned angle and altitude. The activity normally requires a lateral route width of 16NM and altitude range of 1,500 feet to 10,000 feet AGL.

PILOT BRIEFING/PRE-FLIGHT PILOT BRIEFING— A service provided by the FSS to assist pilots in flight planning. Briefing items may include weather information, NOTAMS, military activities, flow control information, and other items as requested. (Refer to AIM)

PILOT IN COMMAND— The pilot responsible for the operation and safety of an aircraft during flight time. (Refer to FAR Part 91)

PILOTS AUTOMATIC TELEPHONE WEATHER ANSWERING SERVICE/PATWAS— A continuous telephone recording containing current and forecast weather information for pilots. (See Flight Service Station) (Refer to AIM)

PILOT'S DISCRETION— When used in conjunction with altitude assignments, means that ATC has offered the pilot the option of starting climb or descent whenever he wishes and conducting the climb or descent at any rate he wishes. He may temporarily level off at any intermediate altitude. However, once he has vacated an altitude, he may not return to that altitude.

PILOT WEATHER REPORT/PIREP— A report of meteorological phenomena encountered by aircraft in flight. (Refer to AIM)

POSITION REPORT/PROGRESS REPORT— A report over a known location as transmitted by an aircraft to ATC. (Refer to AIM)

POSITION SYMBOL— A computer-generated indication shown on a radar display to indicate the mode of tracking.

POSITIVE CONTROL— The separation of all air traffic within designated airspace by air traffic control. (See Positive Control Area)

POSITIVE CONTROL AREA/PCA— (See Controlled Airspace)

PRACTICE INSTRUMENT APPROACH— An instrument approach procedure conducted by a VFR or an IFR aircraft for the purpose of pilot training or proficiency demonstrations.

PRECIPITATION— Any or all forms of water particles (rain, sleet, hail, or snow) that fall from the atmosphere and reach the surface.

PRECISION APPROACH PROCEDURE/PRECISION APPROACH— A standard instrument approach procedure in which an electronic glideslope/glidepath is provided; e.g., ILS/MLS and PAR. (See Instrument Landing System, Microwave Landing System, Precision Approach Radar)

PRECISION APPROACH RADAR/PAR— Radar equipment in some ATC facilities operated by the FAA and/or the military services at joint-use civil/military locations and separate military installations to detect and display azimuth, elevation, and range of aircraft on the final approach course to a runway. This equipment may be used to monitor certain nonradar approaches, but is primarily used to conduct a precision instrument approach (PAR) wherein the controller issues guidance instructions to the pilot based on the aircraft's position in relation to the final approach course (azimuth), the glidepath (elevation), and the distance (range) from the touchdown point on the runway as displayed on the radar scope. (See Glidepath, PAR) (Refer to AIM)

The abbreviation "PAR" is also used to denote preferential arrival routes in ARTCC computers. (See Preferential Routes)

*ICAO-PRECISION APPROACH RADAR/PAR—*Primary radar equipment used to determine the position of an aircraft during final approach, in terms of lateral and vertical deviations relative to a nominal approach path, and in range relative to touchdown.

PREFERENTIAL ROUTES— Preferential routes (PDR's, PAR's, and PDAR's) are adapted in ARTCC computers to accomplish inter/intrafacility controller coordination and to assure that flight data is posted at the proper control positions. Locations having a need for these specific inbound and outbound routes normally publish such routes in local facility bulletins, and their use by pilots minimizes flight plan route amendments. When the workload or traffic situation permits, controllers normally provide radar vectors or assign requested routes to minimize circuitous routing. Preferential routes are usually confined to one ARTCC's area and are referred to by the following names or acronyms:

1. Preferential Departure Route/PDR—A specific departure route from an airport or terminal area to an en route point where there is no further

need for flow control. It may be included in a Standard Instrument Departure (SID) or a Preferred IFR Route.

2. Preferential Arrival Route/PAR—A specific arrival route from an appropriate en route point to an airport or terminal area. It may be included in a Standard Terminal Arrival (STAR) or a Preferred IFR Route. The abbreviation "PAR" is used primarily within the ARTCC and should not be confused with the abbreviation for Precision Approach Radar.
3. Preferential Departure and Arrival Route/PDAR—A route between two terminals which are within or immediately adjacent to one ARTCC's area. PDAR's are not synonomous with Preferred IFR Routes but may be listed as such as they do accomplish essentially the same purpose. (See Preferred IFR Routes, NAS Stage A)

PREFERRED IFR ROUTES— Routes established between busier airports to increase system efficiency and capacity. They normally extend through one or more ARTCC areas and are designed to achieve balanced traffic flows among high density terminals. IFR clearances are issued on the basis of these routes except when severe weather avoidance procedures or other factors dictate otherwise. Preferred IFR Routes are listed in the Airport/Facility Directory. If a flight is planned to or from an area having such routes but the departure or arrival point is not listed in the Airport/Facility Directory, pilots may use that part of a Preferred IFR Route which is appropriate for the departure or arrival point that is listed. Preferred IFR Routes are correlated with SID's and STAR's and may be defined by airways, jet routes, direct routes between NAVAID's, Waypoints, NAVAID radials/DME, or any combinations thereof. (See Standard Instrument Departure, Standard Terminal Arrival, Preferential Routes, Center's Area) (Refer to Airport/Facility Directory and Notices to Airmen Publication)

PREVAILING VISIBILITY— (See Visibility)

PROCEDURE TURN INBOUND— That point of a procedure turn maneuver where course reversal has been completed and an aircraft is established inbound on the intermediate approach segment or final approach course. A report of "procedure turn inbound" is normally used by ATC as a position report for separation purposes. (See Final Approach Course, Procedure Turn, Segments of an Instrument Approach Procedure)

PROCEDURE TURN/PT— The maneuver prescribed when it is necessary to reverse direction to establish an aircraft on the intermediate approach segment or final approach course. The outbound course, direction of turn, distance within which the turn must be completed, and minimum altitude are specified in the procedure. However, unless otherwise restricted, the point at which the turn may be commenced and the type and rate of turn are left to the discretion of the pilot.

ICAO—PROCEDURE TURN— A maneuver in which a turn is made away from a designated track followed by a turn in the opposite direction, both turns being executed so as to permit the aircraft to intercept and proceed along the reciprocal of the designated track.

PROFILE DESCENT— An uninterrupted descent (except where level flight is required for speed adjustment; e.g., 250 knots at 10,000 feet MSL) from cruising altitude/level to interception of a glide slope or to a minimum altitude specified for the initial or intermediate approach segment of a nonprecision instrument approach. The profile descent normally terminates at the approach gate or where the glide slope or other appropriate minimum altitude is intercepted.

PROGRAMMABLE INDICATOR DATA PROCESSOR/PIDP— The PIDP is a modification to the AN/TPX-42 interrogator system currently installed in fixed RAPCON's. The PIDP detects, tracks, and predicts secondary radar aircraft targets. These are displayed by means of computer-generated symbols and alphanumeric characters depicting flight identification, aircraft altitude, ground speed, and flight plan data. Although primary radar targets are not tracked, they are displayed coincident with the secondary radar targets as well as with the other symbols and alphanumerics. The system has the capability of interfacing with ARTCC's.

PROHIBITED AREA— (See Special Use Airspace).

ICAO—PROHIBITED AREA— An airspace of defined dimensions, above the land areas or territorial waters of a State, within which the flight of aircraft is prohibited.

PROPOSED BOUNDARY CROSSING TIME/PBCT— Each center has a PBCT parameter for each internal airport. Proposed internal flight plans are transmitted to the adjacent center if the flight time along the proposed route from the departure airport to the center boundary is less than or equal to the value of PBCT or if airport adaptation specifies transmission regardless of PBCT.

PUBLISHED ROUTE— A route for which an IFR altitude has been established and published; e.g., Federal Airways, Jet Routes, Area Navigation Routes, Specified Direct Routes.

QUADRANT— A quarter part of a circle, centered on a NAVAID, oriented clockwise from magnetic north as follows: NE quadrant 000-089, SE quadrant 090-179, SW quadrant 180-269, NW quadrant 270-359.

QUICK LOOK— A feature of NAS Stage A and ARTS which provides the controller the capability to display full data blocks of tracked aircraft from other control positions.

QUOTA FLOW CONTROL/QFLOW— A flow control procedure by which the Central Flow Control Function (CFCF) restricts traffic to the ARTC Center area having an impacted airport, thereby avoiding sector/area saturation. (See Air Traffic Control Systems Command Center) (Refer to Airport/Facility Directory)

RADAR/RADIO DETECTION AND RANGING— A device which, by measuring the time interval between transmission and reception of radio pulses and correlating the angular orientation of the radiated antenna beam or beams in azimuth and/or elevation, provides information on range, azimuth, and/or elevation of objects in the path of the transmitted pulses.

1. Primary Radar—A radar system in which a minute portion of a radio pulse transmitted from a site is reflected by an object and then received back at that site for processing and display at an air traffic control facility.
2. Secondary Radar/Radar Beacon/ATCRBS—A radar system in which the object to be detected is fitted with cooperative equipment in the form of a radio receiver/transmitter (transponder). Radar pulses transmitted from the searching transmitter/receiver (interrogator) site are received in the cooperative equipment and used to trigger a distinctive transmission from the transponder. This reply transmission, rather than a reflected signal, is then received back at the transmitter/receiver site for processing and display at an air traffic control facility. (See Transponder, Interrogator) (Refer to AIM)

ICAO—RADAR— A radio detection device which provides information on range, azimuth, and/or elevation of objects.

1. Primary Radar—A radar system which uses reflected radio signals.
2. Secondary Radar—A radar system wherein a radio signal transmitted from a radar station initiates the transmission of a radio signal from another station.

RADAR ADVISORY— The provision of advice and information based on radar observations. (See Advisory Service)

RADAR APPROACH— An instrument approach procedure which utilizes Precision Approach Radar (PAR) or Airport Surveillance Radar (ASR). (See PAR Approach, Surveillance Approach, Airport Surveillance Radar, Precision Approach Radar, Instrument Approach Procedure) (Refer to AIM)

ICAO—RADAR APPROACH— An approach, executed by an aircraft, under the direction of a radar controller.

RADAR APPROACH CONTROL FACILITY— A terminal ATC facility that uses radar and nonradar capabilities to provide approach control services to aircraft arriving, departing, or transiting airspace controlled by the facility (see Approach Control Service). Provides radar ATC services to aircraft operating in the vicinity of one or more civil and/ or military airports in a terminal area. The facility may provide services of a ground controlled approach (GCA); i.e., ASR and PAR approaches. A radar approach control facility may be operated by FAA, USAF, US Army, USN, USMC, or jointly by FAA and a military service. Specific facility nomenclatures are used for administrative purposes only and are related to the physical location of the facility and the operating service generally as follows:

Army Radar Approach Control/ARAC (Army).

Radar Air Traffic Control Facility/ RATCF (Navy/FAA).

Radar Approach Control/RAPCON (Air Force/FAA).

Terminal Radar Approach Control/TRACON (FAA).

Tower/Airport Traffic Control Tower/ATCT (FAA). (Only those towers delegated approach control authority.)

RADAR ARRIVAL— An arriving aircraft which is being vectored to the final approach course for an instrument approach or toward the airport for a visual approach. (See Radar Approach, Visual Approach)

RADAR BEACON— (See Radar)

RADAR CONTACT—

1. Used by ATC to inform an aircraft that it is identified on the radar display and radar flight following will be provided until radar identification is terminated. Radar service may also be provided within the limits of necessity and capability. When a pilot is informed of "radar contact," he automatically discontinues reporting over compulsory reporting points. (See Radar Flight Following, Radar Contact Lost, Radar Service, Radar Service Terminated). (Refer to AIM)
2. The term used to inform the controller that the aircraft is identified and approval is granted for the aircraft to enter the receiving controllers airspace.

ICAO—RADAR CONTACT— The situation which exists when the radar blip of a particular aircraft is seen and identified on a radar display.

RADAR CONTACT LOST— Used by ATC to inform a pilot that radar identification of his aircraft has been lost. The loss may be attributed to several things including the aircraft's merging with weather or ground clutter, the aircraft's flying below radar line of sight, the aircraft's entering an area of poor radar return, or a failure of the aircraft transponder or the ground radar equipment. (See Clutter, Radar Contact)

RADAR ENVIRONMENT— An area in which radar service may be provided. (See Radar Contact, Radar Service, Additional Services, Traffic Advisories)

RADAR FLIGHT FOLLOWING— The observation of the progress of radar identified aircraft, whose primary navigation is being provided by the pilot, wherein the controller retains and correlates the aircraft identity with the appropriate target or target symbol displayed on the radar scope. (See Radar Contact, Radar Service) (Refer to AIM)

RADAR IDENTIFICATION— The process of ascertaining that an observed radar target is the radar return from a particular aircraft. (See Radar Contact, Radar Service)

*ICAO—RADAR IDENTIFICATION—*The process of correlating a particular radar blip with a specific aircraft.

RADAR IDENTIFIED AIRCRAFT— An aircraft, the position of which has been correlated with an observed target or symbol on the radar display. (See Radar Contract, Radar Contact Lost)

RADAR MONITORING— (See Radar Service)

RADAR NAVIGATIONAL GUIDANCE— (See Radar Service)

RADAR POINT OUT/POINT OUT— Used between controllers to indicate radar handoff action where the initiating controller plans to retain communications with an aircraft penetrating the other controller's airspace and additional coordination is required.

RADAR ROUTE— A flight path or route over which an aircraft is vectored. Navigational guidance and altitude assignments are provided by ATC. (See Flight Path, Route)

RADAR SEPARATION— (See Radar Service)

RADAR SERVICE— A term which encompasses one or more of the following services based on the use of radar which can be provided by a controller to a pilot of a radar identified aircraft.

1. Radar Separation.—Radar spacing of aircraft in accordance with established minima.

ICAO—RADAR SEPARATION— The separation used when aircraft position information is derived from radar sources.

2. Radar Navigational Guidance.—Vectoring aircraft to provide course guidance.
3. Radar Monitoring.—The radar flight-following of aircraft, whose primary navigation is being performed by the pilot, to observe and note deviations from its authorized flight path, airway, or route. When being applied specifically to radar monitoring of instrument approaches; i.e., with precision approach radar (PAR) or radar monitoring of simultaneous ILS/MLS approaches, it includes advice and instructions whenever an aircraft nears or exceeds the prescribed PAR safety limit or simultaneous ILS/MLS no transgression zone. (See Additional Services, Traffic Advisories)

ICAO—RADAR MONITORING— The use of radar for the purpose of providing aircraft with information and advice relative to significant deviations from nominal flight path.

ICAO—RADAR SERVICE— Term used to indicate a service provided directly by means of radar.

RADAR SERVICE TERMINATED— Used by ATC to inform a pilot that he will no longer be provided any of the services that could be received while in radar contact. Radar service is automatically terminated, and the pilot is not advised in the following cases:

1. An aircraft cancels its IFR flight plan, except within a TCA, TRSA, ARSA, or where Stage II service is provided.
2. An aircraft conducting an instrument, visual, or contact approach has landed or has been instructed to change to advisory frequency.
3. An arriving VFR aircraft, receiving radar service to a tower-controlled airport within a TCA, TRSA, ARSA, or where Stage II service is provided, has landed; or to all other airports, is instructed to change to tower or advisory frequency.
4. An aircraft completes a radar approach.

RADAR SURVEILLANCE— The radar observation of a given geographical area for the purpose of performing some radar function.

RADAR TRAFFIC ADVISORIES— (See Traffic Advisories)

RADAR TRAFFIC INFORMATION SERVICE— (See Traffic Advisories)

RADAR WEATHER ECHO INTENSITY LEVELS— Existing radar systems cannot detect turbulence. However, there is a direct correlation between the degree of turbulence and other weather features associated with thunderstorms and the radar weather echo intensity. The National Weather Service has categorized six levels of radar weather echo intensity. The levels are sometimes expressed during communications as "VIP LEVEL" 1 through 6 (derived from the component of the weather radar that produces the information—Video Integrator and Processor). The following list gives the weather features likely to be associated with these levels during thunderstorm weather situations:

1. Level 1 (WEAK) and Level 2 (MODERATE). Light to moderate turbulence is possible with lightning.
2. Level 3 (STRONG). Severe turbulence possible, lightning.
3. Level 4 (VERY STRONG). Severe turbulence likely, lightning.
4. Level 5 (INTENSE). Severe turbulence, lightning, organized wind gusts, hail likely.
5. Level 6 (EXTREME). Severe turbulence, large hail, lightning, extensive wind gusts, and turbulence.

RADIAL— A magnetic bearing extending from a VOR/VORTAC/TACAN navigation facility.

RADIO—

1. A device used for communication.
2. Used to refer to a flight service station; e.g., "Seattle Radio" is used to call Seattle FSS.

RADIO ALTIMETER/RADAR ALTIMETER— Aircraft equipment which makes use of the reflection of radio waves from the ground to determine the height of the aircraft above the surface.

RADIO BEACON— (See Nondirectional Beacon)

RADIO MAGNETIC INDICATOR/RMI— An aircraft navigational instrument coupled with a gyro compass or similar compass that indicates the direction of a selected NAVAID and indicates bearing with respect to the heading of the aircraft.

RAMP— (See Apron)

READ BACK— Repeat my message back to me.

160-789 0 - 86 - 10

RECEIVING CONTROLLER/FACILITY— A controller/facility receiving control of an aircraft from another controller/facility.

REDUCE SPEED TO (SPEED)— (See Speed Adjustment)

RELEASE TIME— A departure time restriction issued to a pilot by ATC (either directly or through an authorized relay) when necessary to separate a departing aircraft from other traffic.

*ICAO—RELEASE TIME—*Time prior to which an aircraft should be given further clearance or prior to which it should not proceed in case of radio failure.

REMOTE COMMUNICATIONS AIR/GROUND FACILITY/RCAG— An unmanned VHF/UHF transmitter/receiver facility which is used to expand ARTCC air/ground communications coverage and to facilitate direct contact between pilots and controllers. RCAG facilities are sometimes not equipped with emergency frequencies 121.5 MHz and 243.0 MHz. (Refer to AIM)

REMOTE COMMUNICATIONS OUTLET/RCO AND REMOTE TRANSMITTER/RECEIVER/RTR— An unmanned communications facility remotely controlled by air traffic personnel. RCO's serve FSS's. RTR's serve terminal ATC facilities. An RCO or RTR may be UHF or VHF and will extend the communication range of the air traffic facility. There are several classes of RCO's and RTR's. The class is determined by the number of transmitters or receivers. Classes A through G are used primarily for air/ground purposes. RCO and RTR class O facilities are nonprotected outlets subject to undetected and prolonged outages. RCO (O's) and RTR (O's) were established for the express purpose of providing ground-to-ground communications between air traffic control specialists and pilots located at a satellite airport for delivering en route clearances, issuing departure authorizations, and acknowledging instrument flight rules cancellations or departure/landing times. As a secondary function, they may be used for advisory purposes whenever the aircraft is below the coverage of the primary air/ground frequency.

REMOTE TRANSMITTER/RECEIVER/RTR— (See Remote Communications Outlet)

REPORT— Used to instruct pilots to advise ATC of specified information; e.g., "Report passing Hamilton VOR."

REPORTING POINT— A geographical location in relation to which the position of an aircraft is reported. (See Compulsory Reporting Point) (Refer to AIM)

ICAO—REPORTING POINT— A specified geographical location in relation to which the position of an aircraft can be reported.

REQUEST FULL ROUTE CLEARANCE/FRC— Used by pilots to request that the entire route of flight be read verbatim in an ATC clearance. Such request should be made to preclude receiving an ATC clearance based on the original filed flight plan when a filed IFR flight plan has been revised by the pilot, company, or operations prior to departure.

RESCUE COORDINATION CENTER/RCC— A search and rescue (SAR) facility equipped and manned to coordinate and control SAR operations in an area designated by the SAR plan. The U.S. Coast Guard and the U.S. Air Force have responsibility for the operation of RCC's.

ICAO—RESCUE CO-ORDINATION CENTRE— A unit responsible for promoting efficient organization of search and rescue service and for co-ordinating the conduct of search and rescue operations within a search and rescue region.

RESTRICTED AREA— (See Special Use Airspace).

*ICAO—RESTRICTED AREA—*Airspace of defined dimensions, above the land areas or territorial waters of a State, within which the flight of aircraft is restricted in accordance with certain specified conditions.

RESUME OWN NAVIGATION— Used by ATC to advise a pilot to resume his own navigational responsibility. It is issued after completion of a radar vector or when radar contact is lost while the aircraft is being radar vectored. (See Radar Contact Lost, Radar Service Terminated)

RNAV— (See Area Navigation)

RNAV APPROACH— An instrument approach procedure which relies on aircraft area navigation equipment for navigational guidance. (See Instrument Approach Procedure, Area Navigation)

ROAD RECONNAISSANCE (RC)— Military activity requiring navigation along roads, railroads, and rivers. Reconnaissance route/route segments are seldom along a straight line and normally require a lateral route width of 10NM to 30NM and an altitude range of 500 feet to 10,000 feet AGL.

ROGER— I have received all of your last transmission. It should not be used to answer a question requiring a yes or a no answer. (See Affirmative, Negative)

ROLLOUT RVR— (See Visibility)

ROUTE— A defined path, consisting of one or more courses in a horizontal plane, which aircraft traverse over the surface of the earth. (See Airway, Jet Route, Published Route, Unpublished Route)

ROUTE SEGMENT— As used in Air Traffic Control, a part of a route that can be defined by two navigational fixes, two NAVAID's, or a fix and a NAVAID. (See Fix, Route)

*ICAO—ROUTE SEGMENT—*A portion of a route to be flown, as defined by two consecutive significant points specified in a flight plan.

RUNWAY— A defined rectangular area on a land airport prepared for the landing and takeoff run of aircraft along its length. Runways are normally numbered in relation to their magnetic direction rounded off to the nearest 10 degrees; e.g., Runway 01, Runway 25. (See Parallel Runways)

*ICAO—RUNWAY—*A defined rectangular area, on a land aerodrome prepared for the landing and takeoff run of aircraft along its length.

RUNWAY CENTERLINE LIGHTING— (See Airport Lighting)

RUNWAY CONDITION READING/RCR— Numerical decelerometer readings relayed by air traffic controllers at USAF and certain civil bases for use by the pilot in determining runway braking action. These readings are routinely relayed only to USAF and Air National Guard Aircraft. (See Braking Action)

RUNWAY END IDENTIFIER LIGHTS— (See Airport Lighting)

RUNWAY GRADIENT— The average slope, measured in percent, between two ends or points on a runway. Runway gradient is depicted on Government aerodrome sketches when total runway gradient exceeds 0.3%.

RUNWAY HEADING— The magnetic direction indicated by the runway number. When cleared to "fly/maintain runway heading," pilots are expected to comply with the ATC clearance by flying the heading indicated by the runway number without applying any drift correction; e.g., Runway 4, 040° magnetic heading; Runway 20, 200° magnetic heading.

RUNWAY IN USE/ACTIVE RUNWAY/DUTY RUNWAY— Any runway or runways currently being used for takeoff or landing. When multiple runways are used, they are all considered active runways.

RUNWAY LIGHTS— (See Airport Lighting)

RUNWAY MARKINGS— (See Airport Marking Aids.)

RUNWAY PROFILE DESCENT— An instrument flight rules (IFR) air traffic control arrival procedure to a runway published for pilot use in graphic and/or textual form and may be associated with a STAR. Runway Profile Descents provide routing and may depict crossing altitudes, speed restrictions, and headings to be flown from the en route structure to the point where the pilot will receive clearance for and execute an instrument approach procedure. A Runway Profile Descent may apply to more than one runway if so stated on the chart. (Refer to AIM)

RUNWAY USE PROGRAM— A noise abatement runway selection plan designed to enhance noise abatement efforts with regard to airport communities for arriving and departing aircraft. These plans are developed into runway use programs and apply to all turbojet aircraft 12,500 pounds or heavier; turbojet aircraft less than 12,500 pounds are included only if the airport proprietor determines that the aircraft creates a noise problem. Runway use programs are coordinated with FAA offices, and safety criteria used in these programs are developed by the Office of Flight Operations. Runway use programs are administered by the Air Traffic Service as "Formal" or "Informal" programs.

1. Formal Runway Use Program—An approved noise abatement program which is defined and acknowledged in a Letter of Understanding between Flight Operations, Air Traffic Service, the airport proprietor, and the users. Once established, participation in the program is mandatory for aircraft operators and pilots as provided for in FAR 91.87.
2. Informal Runway Use Program—An approved noise abatement program which does not require a Letter of Understanding, and participation in the program is voluntary for aircraft operators/pilots.

RUNWAY VISIBILITY VALUE— (See Visibility)

RUNWAY VISUAL RANGE— (See Visibility)

SAFETY ALERT— A safety alert issued by ATC to aircraft under their control if ATC is aware the aircraft is at an altitude which, in the controller's judgment, places the aircraft in unsafe proximity to terrain, obstructions, or other aircraft. The controller may discontinue the issuance of further alerts if the pilot advises he is taking action to correct the situation or has the other aircraft in sight.

1. Terrain/Obstruction Alert—A safety alert issued by ATC to aircraft under their control if ATC is aware the aircraft is at an altitude which, in the controller's judgment, places the aircraft in unsafe proximity to terrain/obstructions; e.g., "Low Altitude Alert, check your altitude immediately."
2. Aircraft Conflict Alert—A safety alert issued by ATC to aircraft under their control if ATC is aware of an aircraft that is not under their control at an altitude which, in the controller's judgment, places both aircraft in unsafe proximity to each other. With the alert, ATC will offer the pilot an alternate course of action when feasible; e.g., "Traffic Alert, advise you turn right heading zero niner zero or climb to eight thousand immediately."

The issuance of a safety alert is contingent upon the capability of the controller to have an awareness of an unsafe condition. The course of action provided will be predicated on other traffic under ATC control. Once the alert is issued, it is solely the pilot's prerogative to determine what course of action, if any, he will take.

SAIL BACK— A maneuver during high wind conditions (usually with power off) where float plane movement is controlled by water rudders/opening and closing cabin doors.

SAY AGAIN— Used to request a repeat of the last transmission. Usually specifies transmission or portion thereof not understood or received; e.g., "Say again all after ABRAM VOR."

SAY ALTITUDE— Used by ATC to ascertain an aircraft's specific altitude/flight level. When the aircraft is climbing or descending, the pilot should state the indicated altitude rounded to the nearest 100 feet.

SAY HEADING— Used by ATC to request an aircraft heading. The pilot should state the actual heading of the aircraft.

SEA LANE— A designated portion of water outlined by visual surface markers for and intended to be used by aircraft designed to operate on water.

SEARCH AND RESCUE FACILITY— A facility responsible for maintaining and operating a search and rescue (SAR) service to render aid to persons and property in distress. It is any SAR unit, station, NET, or other operational activity which can be usefully employed during an SAR Mission; e.g., a Civil Air Patrol Wing, or a Coast Guard Station. (See Search and Rescue)

SEARCH AND RESCUE/SAR— A service which seeks missing aircraft and assists those found to be in need of assistance. It is a cooperative effort using the facilities and services of available Federal, state and local agencies. The U.S. Coast Guard is responsible for coordination of search and rescue for the Maritime Region, and the U.S. Air Force is responsible for search and rescue for the Inland Region. Information pertinent to search and rescue should be passed through any air traffic facility or be transmitted directly to the Rescue Coordination Center by telephone. (See Flight Service Station, Rescue Coordination Center) (Refer to AIM)

SEE AND AVOID— A visual procedure wherein pilots of aircraft flying in visual meteorological conditions (VMC), regardless of type of flight plan, are charged with the responsibility to observe the presence of other aircraft and to maneuver their aircraft as required to avoid the other aircraft. Right-of-way rules are contained in FAR, Part 91. (See Instrument Flight Rules, Visual Flight Rules, Visual Meteorological Conditions, Instrument Meteorological Conditions)

SEGMENTED CIRCLE— A system of visual indicators designed to provide traffic pattern information at airports without operating control towers. (Refer to AIM)

SEGMENTS OF AN INSTRUMENT APPROACH PROCEDURE— An instrument approach procedure may have as many as four separate segments depending on how the approach procedure is structured.

1. Initial Approach—The segment between the initial approach fix and the intermediate fix or the point where the aircraft is established on the intermediate course or final approach course.
2. Intermediate Approach—The segment between the intermediate fix or point and the final approach fix.
3. Final Approach—The segment between the final approach fix or point and the runway, airport, or missed approach point.
4. Missed Approach—The segment between the missed approach point or the point of arrival at decision height and the missed approach fix at the prescribed altitude. (Refer to FAR, Part 97)

ICAO

1. *Initial Approach*—That part of an instrument approach procedure consisting of the first approach to the first navigational facility associated with the procedure, or to a predetermined fix.
2. *Intermediate Approach*—That part of an instrument approach procedure from the first arrival at the first navigational facility or predetermined fix, to the beginning of the final approach.
3. *Final Approach*—That part of an instrument approach procedure from the time the aircraft has:
    a. Completed the last procedure turn or base turn where one is specified, or
    b. Crossed a specified fix, or
    c. Intercepted the last track specified for the procedures until it has crossed a point in the vicinity of an aerodrome from which:
        (1) A landing can be made, or
        (2) A missed approach procedure is initiated.
4. *Missed Approach Procedure*—The procedure to be followed if, after an instrument approach, a landing is not effected and occurring normally:
    a. When the aircraft has descended to the decision height and has not established visual contact, or
    b. When directed by air traffic control to pull up or to go around again.

SEPARATION— In air traffic control, the spacing of aircraft to achieve their safe and orderly movement in flight and while landing and taking off. (See Separation Minima)

ICAO—SEPARATION—Spacing between aircraft, levels or tracks.

SEPARATION MINIMA— The minimum longitudinal, lateral, or vertical distances by which aircraft are spaced through the application of air traffic control procedures. (See Separation)

SEVERE WEATHER AVOIDANCE PLAN/SWAP— An approved plan to minimize the affect of severe weather on traffic flows in impacted terminal and/or ARTCC areas. SWAP is normally implemented to provide the least disruption to the ATC system when flight through portions of airspace is difficult or impossible due to severe weather.

SHORT RANGE CLEARANCE— A clearance issued to a departing IFR flight which authorizes IFR flight to a specific fix short of the destination while air traffic control facilities are coordinating and obtaining the complete clearance.

SHORT TAKEOFF AND LANDING AIRCRAFT/STOL AIRCRAFT— An aircraft which, at some weight within its approved operating weight, is capable of operating from a STOL runway in compliance with the applicable STOL characteristics, airworthiness, operations, noise, and pollution standards. (See Vertical Takeoff and Landing Aircraft)

SIDESTEP MANEUVER— A visual maneuver accomplished by a pilot at the completion of an instrument approach to permit a straight-in landing on a parallel runway not more than 1,200 feet to either side of the runway to which the instrument approach was conducted. (Refer to AIM)

***SIGMET* /WS/SIGNIFICANT METEOROLOGICAL INFORMATION—** A weather advisory issued concerning weather significant to the safety of all aircraft. SIGMET advisories cover severe and extreme turbulence, severe icing, and widespread dust or sandstorms that reduce visibility to less than 3 miles. (See Convective SIGMET, CWA, and AIRMET) (Refer to AIM).

ICAO—SIGMET INFORMATION— Information prepared by a meteorological watch office regarding the occurrence or expected occurrence of one or more of the following phenomena:

1. At subsonic cruising levels:

    Active thunderstorm area.
    Tropical revolving storm.
    Severe line squall.
    Heavy hail.
    Severe turbulence.
    Severe icing.
    Marked mountain waves.
    Widespread sandstorm/duststorm.

2. At transonic levels and supersonic cruising levels:

    Moderate or severe turbulence.
    Cumulonimbus clouds.
    Hail.

SIMPLIFIED DIRECTIONAL FACILITY/SDF— A NAVAID used for nonprecision instrument approaches. The final approach course is similar to that of an ILS localizer except that the SDF course may be offset from the runway, generally not more than 3 degrees, and the course may be wider than the localizer, resulting in a lower degree of accuracy. (Refer to AIM)

SIMULATED FLAMEOUT/SFO— A practice approach by a jet aircraft (normally military) at idle thrust to a runway. The approach may start at a relatively high altitude over a runway (high key) and may continue on a relatively high and wide downwind leg with a high rate of descent and a continuous turn to final. It terminates in a landing or low approach. The purpose of this approach is to simulate a flameout. (See Flameout)

SIMULTANEOUS ILS/MLS APPROACHES— An approach system permitting simultaneous ILS/MLS approaches to airports having parallel runways separated by at least 4,300 feet between centerlines. Integral parts of a total system are ILS/MLS, radar, communications, ATC procedures, and appropriate airborne equipment. (See Parallel Runways) (Refer to AIM)

SINGLE DIRECTION ROUTES— Preferred IFR Routes which are sometimes depicted on high altitude en route charts and which are normally flown in one direction only. (See Preferred IFR Route) (Refer to Airport/Facility Directory)

SINGLE FREQUENCY APPROACH/SFA— A service provided under a letter of agreement to military single-piloted turbojet aircraft which permits use of a single UHF frequency during approach for landing. Pilots will not normally be required to change frequency from the beginning of the approach to touchdown except that pilots conducting an en route descent are required to change frequency when control is transferred from the air route traffic control center to the terminal facility. The abbreviation "SFA" in the DOD FLIP IFR Supplement under "Communications" indicates this service is available at an aerodrome.

SINGLE-PILOTED AIRCRAFT— A military turbojet aircraft possessing one set of flight controls, tandem cockpits, or two sets of flight controls but operated by one pilot is considered single-piloted by ATC when determining the appropriate air traffic service to be applied. (See Single Frequency Approach)

SLASH— A radar beacon reply displayed as an elongated target.

SLOW TAXI— To taxi a float plane at low power or low RPM.

SPEAK SLOWER— Used in verbal communications as a request to reduce speech rate.

SPECIAL EMERGENCY— A condition of air piracy or other hostile act by a person(s) aboard an aircraft which threatens the safety of the aircraft or its passengers.

SPECIAL IFR— (See Fixed-Wing Special IFR)

SPECIAL INSTRUMENT APPROACH PROCEDURE— (See Instrument Approach Procedure)

SPECIAL USE AIRSPACE— Airspace of defined dimensions identified by an area on the surface of the earth wherein activities must be confined because of their nature and/or wherein limitations may be imposed upon aircraft operations that are not a part of those activities. TYPES OF SPECIAL USE AIRSPACE:

1. Alert Area—Airspace which may contain a high volume of pilot training activities or an unusual type of aerial activity, neither of which is hazardous to aircraft. Alert Areas are depicted on aeronautical charts for the information of nonparticipating pilots. All activities within an Alert Area are conducted in accordance with Federal Aviation Regulations, and pilots of participating aircraft as well as pilots transiting the area are equally responsible for collision avoidance.

2. Controlled Firing Area—Airspace wherein activities are conducted under conditions so controlled as to eliminate hazards to nonparticipating aircraft and to ensure the safety of persons and property on the ground.

3. Military Operations Area (MOA)—An MOA is an airspace assignment of defined vertical and lateral dimensions established outside positive control areas to separate/segregate certain military activities from IFR traffic and to identify for VFR traffic where these activities are conducted. (Refer to AIM).

4. Prohibited Area—Designated airspace within which the flight of aircraft is prohibited. (Refer to En Route Charts, AIM).

5. Restricted Area—Airspace designated under FAR, Part 73, within which the flight of aircraft, while not wholly prohibited, is subject to restriction. Most restricted areas are designated joint use and IFR/VFR operations in the area may be authorized by the controlling ATC facility when it is not being utilized by the using agency. Restricted areas are depicted on en route charts.

Where joint use is authorized, the name of the ATC controlling facility is also shown. (Refer to FAR, Part 73 and AIM)

6. Warning Area—Airspace which may contain hazards to nonparticipating aircraft in international airspace.

SPECIAL VFR CONDITIONS— Weather conditions in a control zone which are less than basic VFR and in which some aircraft are permitted flight under Visual Flight Rules. (See Special VFR Operations) (Refer to FAR, Part 91)

SPECIAL VFR OPERATIONS— Aircraft operating in accordance with clearances within control zones in weather conditions less than the basic VFR weather minima. Such operations must be requested by the pilot and approved by ATC. (See Special VFR Conditions)

ICAO—SPECIAL VFR FLIGHT—A controlled VFR flight authorized by air traffic control to operate within a control zone under meteorological conditions below the visual meteorological conditions.

SPEED— (See Airspeed, Groundspeed)

SPEED ADJUSTMENT— An ATC procedure used to request pilots to adjust aircraft speed to a specific value for the purpose of providing desired spacing. Pilots are expected to maintain a speed of plus or minus 10 knots or 0.02 mach number of the specified speed.

Examples of speed adjustments are:

1. "Increase/reduce speed to mach point (number)."
2. "Increase/reduce speed to (speed in knots)" or "Increase/reduce speed (number of knots) knots."
3. "If practical, reduce speed to (speed)," or "If practical, reduce speed (number of) knots."

SPEED BRAKES/DIVE BRAKES— Moveable aerodynamic devices on aircraft that reduce airspeed during descent and landing.

SQUAWK (Mode, Code, Function)— Activate specific modes/codes/functions on the aircraft transponder; e.g., "Squawk three/alpha, two one zero five, low." (See Transponder)

STAGE I/II/III SERVICE— (See Terminal Radar Program)

STANDARD INSTRUMENT APPROACH PROCEDURE/SIAP— (See Instrument Approach Procedure)

STANDARD INSTRUMENT DEPARTURE/SID— A preplanned instrument flight rule (IFR) air traffic control departure procedure printed for pilot use in graphic and/or textual form. SID's provide transition from the terminal to the appropriate en route structure. (See IFR Takeoff Minima and Departure Procedures) (Refer to AIM)

STANDARD RATE TURN— A turn of three degrees per second.

STANDARD TERMINAL ARRIVAL/STAR— A preplanned instrument flight rule (IFR) air traffic control arrival procedure published for pilot use in graphic and/or textual form. STAR's provide transition from the en route structure to an outer fix or an instrument approach fix/arrival waypoint in the termina area.

STAND BY— Means the controller or pilot must pause for a few seconds, usually to attend to other duties of a higher priority. Also means to wait as in "stand by for clearance." If a delay is lengthy, the caller should reestablish contact.

STATIONARY RESERVATIONS— Altitude reservations which encompass activities in a fixed area. Stationary reservations may include activities, such as special tests of weapons systems or equipment, certain U.S. Navy carrier, fleet, and anti-submarine operations, rocket, missile and drone operations, and certain aerial refueling or similar operations.

STEPDOWN FIX— A fix permitting additional descent within a segment of an instrument approach procedure by identifying a point at which a controlling obstacle has been safely overflown.

STEP TAXI— To taxi a float plane at full power or high RPM.

STEP TURN— A maneuver used to put a float plane in a planing configuration prior to entering an active sea lane for takeoff. The STEP TURN maneuver should only be used upon pilot request.

STEREO ROUTE— A routinely used route of flight established by users and ARTCC's identified by a coded name; e.g., ALPHA 2. These routes minimize flight plan handling and communications.

STOP ALTITUDE SQUAWK— Used by ATC to inform an aircraft to turn-off the automatic altitude reporting feature of its transponder. It is issued when the verbally reported altitude varies 300 feet or more from the automatic altitude report. (See Altitude Readout, Transponder)

STOP AND GO— A procedure wherein an aircraft will land, make a complete stop on the runway, and then commence a takeoff from that point. (See Low Approach, Option Approach)

STOPOVER FLIGHT PLAN— A flight plan format which permits in a single submission the filing of a sequence of flight plans through interim full-stop destinations to a final destination.

STOP SQUAWK (Mode or Code)— Used by ATC to tell the pilot to turn specified functions of the aircraft transponder off. (See Stop Altitude Squawk, Transponder)

STOP STREAM/BURST/BUZZER— Used by ATC to request a pilot to suspend electronic countermeasure activity. (See Jamming)

STOPWAY— An area beyond the takeoff runway designated by the airport authorities as able to support an airplane during an aborted takeoff. (Refer to FAR, Part 1)

STRAIGHT-IN APPROACH—IFR— An instrument approach wherein final approach is begun without first having executed a procedure turn, not necessarily completed with a straight-in landing or made to straight-in landing minimums. (See Straight-in Landing, Landing Minimums, Straight-in Approach-VFR)

STRAIGHT-IN APPROACH—VFR— Entry into the traffic pattern by interception of the extended runway centerline (final approach course) without executing any other portion of the traffic pattern. (See Traffic Pattern)

STRAIGHT-IN LANDING— A landing made on a runway aligned within 30° of the final approach course following completion of an instrument approach. (See Straight-in Approach-IFR)

STRAIGHT-IN LANDING MINIMUMS/STRAIGHT-IN MINIMUMS— (See Landing Minimums)

SUBSTITUTE ROUTE— A route assigned to pilots when any part of an airway or route is unusable because of NAVAID status. These routes consist of:

1. Substitute routes which are shown on U.S. Government charts.
2. Routes defined by ATC as specific NAVAID radials or courses.
3. Routes defined by ATC as direct to or between NAVAID's.

SUNSET AND SUNRISE— The mean solar times of sunset and sunrise as published in the Nautical Almanac, converted to local standard time for the locality concerned. Within Alaska, the end of evening civil twilight and the beginning of morning civil twilight, as defined for each locality.

SUPER HIGH FREQUENCY/SHF—The frequency band between 3 and 30 gigahertz (gHz). The elevation and azimuth stations of the microwave landing system operate from 5031MHz to 5091MHz in this spectrum.

SURVEILLANCE APPROACH— An instrument approach wherein the air traffic controller issues instructions, for pilot compliance, based on aircraft position in relation to the final approach course (azimuth), and the distance (range) from the end of the runway as displayed on the controller's radar scope. The controller will provide recommended altitudes on final approach if requested by the pilot. (See PAR Approach) (Refer to AIM)

SYSTEM STRATEGIC NAVIGATION (SN)— Military activity accomplished by navigating along a preplanned route using internal aircraft systems to maintain a desired track. This activity normally requires a lateral route width of 10NM and altitude range of 1,000 feet to 6,000 feet AGL with some route segments that permit terrain following.

TACAN-ONLY AIRCRAFT— An aircraft, normally military, possessing TACAN with DME but no VOR navigational system capability. Clearances must specify TACAN or VORTAC fixes and approaches.

TACTICAL AIR NAVIGATION/TACAN— An ultrahigh frequency electronic rho-theta air navigation aid which provides suitably equipped aircraft a continuous indication of bearing and distance to the TACAN station. (See VORTAC) (Refer to AIM)

TARGET— The indication shown on a radar display resulting from a primary radar return or a radar beacon reply. (See Radar, Target Symbol)

*ICAO—TARGET—*In radar:

1. Generally, any discrete object which reflects or retransmits energy back to the radar equipment.
2. Specifically, an object of radar search or surveillance.

TARGET SYMBOL— A computer-generated indication shown on a radar display resulting from a primary radar return or a radar beacon reply.

TAXI— The movement of an airplane under its own power on the surface of an airport (FAR Part 135.100-Note). Also, it describes the surface movement of helicopters equipped with wheels. (See Air Taxi, Hover Taxi) (Refer to AIM)

TAXI INTO POSITION AND HOLD— Used by ATC to inform a pilot to taxi onto the departure runway in takeoff position and hold. It is not authorization for takeoff. It is used when takeoff clearance cannot immediately be issued because of traffic or other reasons. (See Hold, Cleared for Takeoff)

TAXI PATTERNS— Patterns established to illustrate the desired flow of ground traffic for the different runways or airport areas available for use.

TERMINAL AREA— A general term used to describe airspace in which approach control service or airport traffic control service is provided.

TERMINAL AREA FACILITY— A facility providing air traffic control service for arriving and departing IFR, VFR, Special VFR, and on occasion en route aircraft. (See Approach Control, Tower)

TERMINAL CONTROL AREA— (See Controlled Airspace)

TERMINAL RADAR PROGRAM— A national program instituted to extend the terminal radar services provided IFR aircraft to VFR aircraft. Pilot participation in the program is urged but is not mandatory. The program is divided into two parts and referred to as Stage II and Stage III. The Stage service provided at a particular location is contained in the Airport/Facility Directory.

1. Stage I originally comprised two basic radar services (traffic advisories and limited vectoring to VFR aircraft). These services are provided by all commissioned terminal radar facilities, but the term "Stage I" has been deleted from use.
2. Stage II/Radar Advisory and Sequencing for VFR Aircraft—Provides, in addition to the basic radar services, vectoring and sequencing on a full-time basis to arriving VFR aircraft. The purpose is to adjust the flow of arriving IFR and VFR aircraft into the traffic pattern in a safe and orderly manner and to provide traffic advisories to departing VFR aircraft.
3. Stage III/Radar Sequencing and Separation Service for VFR Aircraft—Provides, in addition to the basic radar services and Stage II, separation be-

tween all participating VFR aircraft. The purpose is to provide separation between all participating VFR aircraft and all IFR aircraft operating within the airspace defined as a Terminal Radar Service Area (TRSA) or Terminal Control Area (TCA). (See Controlled Airspace, Terminal Radar Service Area) (Refer to AIM, Airport/Facility Directory)

TERMINAL RADAR SERVICE AREA/TRSA— Airspace surrounding designated airports wherein ATC provides radar vectoring, sequencing, and separation on a full-time basis for all IFR and participating VFR aircraft. Service provided in a TRSA is called Stage III Service. The AIM contains an explanation of TRSA. TRSA's are depicted on VFR aeronautical charts. Pilot participation is urged but is not mandatory. (See Terminal Radar Program) (Refer to AIM, Airport/Facility Directory)

TERRAIN FOLLOWING/TF— The flight of a military aircraft maintaining a constant AGL altitude above the terrain or the highest obstruction. The altitude of the aircraft will constantly change with the varying terrain and/or obstruction.

TETRAHEDRON— A device normally located on uncontrolled airports and used as a landing direction indicator. The small end of a tetrahedron points in the direction of landing. At controlled airports, the tetrahedron, if installed, should be disregarded because tower instructions supersede the indicator. (See Segmented Circle) (Refer to AIM)

THAT IS CORRECT— The understanding you have is right.

THRESHOLD— The beginning of that portion of the runway usable for landing. (See Airport Lighting, Displaced Threshold)

THRESHOLD CROSSING HEIGHT/TCH— The theoretical height above the runway threshold at which the aircraft's glideslope antenna would be if the aircraft maintains the trajectory established by the mean ILS glideslope or MLS glidepath. (See Glide Slope, Threshold)

THRESHOLD LIGHTS— (See Airport Lighting)

TIME GROUP— Four digits representing the hour and minutes from the 24-hour clock. Time groups without time zone indicators are understood to be UTC (Coordinated Universal Time); e.g., "0205." The term "Zulu" is used when ATC procedures require a reference to UTC. A time zone designator is used to indicate local time; e.g., "0205M." The end and the beginning of the day are shown by "2400" and "0000," respectively.

TORCHING— The burning of fuel at the end of an exhaust pipe or stack of a reciprocating aircraft engine, the result of an excessive richness in the fuel air mixture.

*ICAO—TOTAL ESTIMATED ELAPSED TIME/ TOTAL EET—*For IFR flights, the estimated time required from takeoff to arrive over that designated point, defined by reference to navigation aids, from which it is intended that an instrument approach procedure will be commenced, or if no navigation aid is associated with the destination aerodrome, to arrive over the destination aerodrome For VFR flights, the estimated time required from takeoff to arrive over the destination aerodrome (for use in international flight planning). (See Estimated Elapsed Time)

TOUCH-AND-GO/TOUCH-AND-GO LANDING— An operation by an aircraft that lands and departs on a runway without stopping or exiting the runway.

TOUCHDOWN—

1. The point at which an aircraft first makes contact with the landing surface.
2. Concerning a precision radar approach (PAR), it is the point where the glide path intercepts the landing surface.

ICAO—TOUCHDOWN— The point where the nominal glide path intercepts the runway.

TOUCHDOWN RVR— (See Visibility)

TOUCHDOWN ZONE— The first 3,000 feet of the runway beginning at the threshold. The area is used for determination of Touchdown Zone Elevation in the development of straight-in landing minimums for instrument approaches.

TOUCHDOWN ZONE ELEVATION/TDZE— The highest elevation in the first 3,000 feet of the landing surface. TDZE is indicated on the instrument approach procedure chart when straight-in landing minimums are authorized. (See Touchdown Zone)

TOUCHDOWN ZONE LIGHTING— (See Airport Lighting)

TOWER/AIRPORT TRAFFIC CONTROL TOWER— A terminal facility that uses air/ground communications, visual signaling, and other devices to provide ATC services to aircraft operating in the vicinity of an airport or on the movement area. Authorizes aircraft to land or takeoff at the airport controlled by the tower or to transit the airport traffic area regardless of flight plan or weather conditions (IFR or VFR). A tower may also provide approach control services (radar or nonradar). (See Airport Traffic Area, Airport Traffic Control Service, Approach Control/Approach Control Facility, Approach Control Service, Movement Area, Tower En Route Control Service/Tower to Tower) (Refer to AIM)

ICAO—AERODROME CONTROL TOWER— A unit established to provide air traffc control service to aerodrome traffic.

TOWER EN ROUTE CONTROL SERVICE/TOWER TO TOWER— The control of IFR en route traffic within delegated airspace between two or more adjacent approach control facilities. This service is designed to expedite traffic and reduce control and pilot communication requirements.

TPX-42— A numeric beacon decoder equipment/ system. It is designed to be added to terminal radar systems for beacon decoding. It provides rapid target identification, reinforcement of the primary radar target, and altitude information from Mode C. (See Automated Radar Terminal Systems, Transponder)

TRACK— The actual flight path of an aircraft over the surface of the earth. (See Course, Route, Flight Path)

ICAO—TRACK—The projection on the earth's surface of the path of an aircraft, the direction of which path at any point is usually expressed in degrees from north (true, magnetic, or grid).

TRAFFIC—

1. A term used by a controller to transfer radar identification of an aircraft to another controller for the purpose of coordinating separation action. Traffic is normally issued (a) in response to a handoff or point out, (b) in anticipation of a handoff or point out, or (c) in conjunction with a request for control of an aircraft.
2. A term used by ATC to refer to one or more aircraft.

TRAFFIC ADVISORIES— Advisories issued to alert pilots to other known or observed air traffic which may be in such proximity to the position or intended route of flight of their aircraft to warrant their attention. Such advisories may be based on:

1. Visual observation.
2. Observation of radar identified and nonidentified aircraft targets on an ATC radar display, or
3. Verbal reports from pilots or other facilities.

The word "traffic" followed by additional information, if known, is used to provide such advisories; e.g., "Traffic, 2 o'clock, one zero miles, southbound, eight thousand."

Traffic advisory service will be provided to the extent possible depending on higher priority duties of the controller or other limitations; e.g., radar limitations, volume of traffic, frequency congestion, or controller workload. Radar/nonradar traffic advisories do not relieve the pilot of his responsibility to see and avoid other aircraft. Pilots are cautioned that there are many times when the controller is not able to give traffic advisories concerning all traffic in the aircraft's proximity; in other words, when a pilot requests or is receiving traffic advisories, he should not assume that all traffic will be issued. (Refer to AIM, Radar Traffic Information Service)

(Identification), TRAFFIC ALERT. ADVISE YOU TURN LEFT/RIGHT (specific heading if appropriate), AND/OR CLIMB/DESCEND (specific altitude if appropriate) IMMEDIATELY. (See Safety Alert)

TRAFFIC INFORMATION— (See Traffic Advisories)

TRAFFIC IN SIGHT— Used by pilots to inform a controller that previously issued traffic is in sight. (See Negative Contact, Traffic Advisories)

TRAFFIC NO LONGER A FACTOR— Indicates that the traffic described in a previously issued traffic advisory is no longer a factor.

TRAFFIC PATTERN— The traffic flow that is prescribed for aircraft landing at, taxiing on, or taking off from an airport. The components of a typical traffic pattern are upwind leg, crosswind leg, downwind leg, base leg, and final approach.

1. Upwind Leg—A flight path parallel to the landing runway in the direction of landing.
2. Crosswind Leg—A flight path at right angles to the landing runway off its upwind end.
3. Downwind Leg—A flight path parallel to the landing runway in the direction opposite to landing. The downwind leg normally extends between the crosswind leg and the base leg.
4. Base Leg—A flight path at right angles to the landing runway off its approach end. The base leg normally extends from the downwind leg to the intersection of the extended runway centerline.
5. Final Approach—A flight path in the direction of landing along the extended runway centerline. The final approach normally extends from the base leg to the runway. An aircraft making a straight-in approach VFR is also considered to be on final approach.

(See Straight-In Approach—VFR, Taxi Patterns) (Refer to AIM, FAR Part 91)

ICAO—AERODROME TRAFFIC CIRCUIT— The specified path to be flown by aircraft operating in the vicinity of an aerodrome.

TRANSCRIBED WEATHER BROADCAST/TWEB— A continuous recording of meteorological and aeronautical information that is broadcast on L/MF and VOR facilities for pilots. (Refer to AIM)

TRANSFER OF CONTROL— That action whereby the responsibility for the separation of an aircraft is transferred from one controller to another.

ICAO—TRANSFER OF CONTROL— Transfer of responsibility for providing air traffic control service.

TRANSFERRING CONTROLLER/FACILITY— A controller/facility transferring control of an aircraft to another controller/facility.

ICAO—TRANSFERRING UNIT/CONTROLLER— Air Traffic Control Unit/Air Traffic Controller in the process of transferring the responsibility for providing air traffic control service to an aircraft to the next air traffic control unit/air traffic controller along the route of flight.

TRANSITION—

1. The general term that describes the change from one phase of flight or flight condition to another; e.g., transition from en route flight to the approach or transition from instrument flight to visual flight.
2. A published procedure (SID Transition) used to connect the basic SID to one of several en route airways/jet routes, or a published procedure (STAR Transition) used to connect one of several en route airways/jet routes to the basic STAR. (Refer to SID/STAR Charts)

TRANSITION AREA— (See Controlled Airspace)

TRANSMISSOMETER— An apparatus used to determine visibility by measuring the transmission of light through the atmosphere. It is the measurement source for determining runway visual range (RVR) and runway visibility value (RVV). (See Visibility)

TRANSMITTING IN THE BLIND/BLIND TRANSMISSION— A transmission from one station to other stations in circumstances where two-way communication cannot be established, but where it is believed that the called stations may be able to receive the transmission.

TRANSPONDER— The airborne radar beacon receiver/transmitter portion of the Air Traffic Control Radar Beacon System (ATCRBS) which automatically receives radio signals from interrogators on the ground, and selectively replies with a specific reply pulse or pulse group only to those interrogations being received on the mode to which it is set to respond. (See Interrogator) (Refer to AIM)

*ICAO—TRANSPONDER—*A receiver/transmitter which will generate a reply signal upon proper interrogation; the interrogation and reply being on different frequencies.

TURBOJET AIRCRAFT— An aircraft having a jet engine in which the energy of the jet operates a turbine which in turn operates the air compressor.

TURBOPROP AIRCRAFT— An aircraft having a jet engine in which the energy of the jet operates a turbine which drives the propeller.

T-VOR/TERMINAL-VERY HIGH FREQUENCY OMNIDIRECTIONAL RANGE STATION— A very high frequency terminal omnirange station located on or near an airport and used as an approach aid. (See Navigational Aid, VOR)

TWO WAY RADIO COMMUNICATIONS FAILURE— (See Lost Communications)

ULTRAHIGH FREQUENCY/UHF— The frequency band between 300 and 3,000 MHz. The bank of radio frequencies used for military air/ground voice communications. In some instances this may go as low as 225 MHz and still be referred to as UHF.

ULTRALIGHT VEHICLE— An aeronautical vehicle operated for sport or recreational purposes which does not require FAA registration, an airworthiness certificate, nor pilot certification. They are primarily single occupant vehicles, although some two-place vehicles are authorized for training purposes. Operation of an ultralight vehicle in certain airspace requires authorization from ATC. (See FAR 103)

UNABLE— Indicates inability to comply with a specific instruction, request, or clearance.

UNCONTROLLED AIRSPACE— Uncontrolled airspace is that portion of the airspace that has not been designated as continental control area, control area, control zone, terminal control area, or transition area and within which ATC has neither the authority nor the responsibility for exercising control over air traffic. (See Controlled Airspace)

UNDER THE HOOD— Indicates that the pilot is using a hood to restrict visibility outside the cockpit while simulating instrument flight. An appropriately rated pilot is required in the other control seat while this operation is being conducted. (Refer to FAR, Part 91)

UNICOM— A nongovernment communication facility which may provide airport information at certain airports. Locations and frequencies of UNICOMs are shown on aeronautical charts and publications. (Refer to AIM, Airport/Facility Directory)

UNPUBLISHED ROUTE— A route for which no minimum altitude is published or charted for pilot use. It may include a direct route between NAVAIDS, a radial, a radar vector, or a final approach course beyond the segments of an instrument approach procedure. (See Published Route, Route)

UPWIND LEG— (See Traffic Pattern)

URGENCY— A condition of being concerned about safety, and of requiring timely but not immediate assistance; a potential Distress condition.

ICAO—URGENCY— A condition concerning the safety of an aircraft or other vehicle, or of person on board or in sight, but which does not require immediate assistance.

VECTOR— A heading issued to an aircraft to provide navigational guidance by radar.

ICAO—RADAR VECTORING— Provision of navigational guidance to aircraft in the form of specific headings, based on the use of radar.

VERIFY— Request confirmation of information; e.g., "verify assigned altitude."

VERIFY SPECIFIC DIRECTION OF TAKEOFF (OR TURNS AFTER TAKEOFF)— Used by ATC to ascertain an aircraft's direction of takeoff and/or direction of turn after takeoff. It is normally used for IFR departures from an airport not having a control tower. When direct communication with the pilot is not possible, the request and information may be relayed through an FSS, dispatcher, or by other means. (See IFR Takeoff Minimums and Departure Procedures)

VERTICAL SEPARATION— Separation established by assignment of different altitudes or flight levels. (See Separation)

*ICAO—VERTICAL SEPARATION—*Separation between aircraft expressed in units of vertical distance.

VERTICAL TAKEOFF AND LANDING AIRCRAFT/VTOL AIRCRAFT— Aircraft capable of vertical climbs and/or descents and of using very short runways or small areas for takeoff and landings. These aircraft include, but are not limited to, helicopters. (See Short Takeoff and Landing Aircraft)

VERY HIGH FREQUENCY/VHF— The frequency band between 30 and 300 MHz. Portions of this band, 108 to 118 MHz, are used for certain NAVAIDS; 118 to 136 MHz are used for civil air/ground voice communications. Other frequencies in this band are used for purposes not related to air traffic control.

VERY LOW FREQUENCY/VLF— The frequency band between 3 and 30 kHz.

VFR AIRCRAFT/VFR FLIGHT— An aircraft conducting flight in accordance with visual flight rules. (See Visual Flight Rules)

VFR CONDITIONS— Weather conditions equal to or better than the minimum for flight under visual flight rules. The term may be used as an ATC clearance/instruction only when:

1. An IFR aircraft requests a climb/descent in VFR conditions.
2. The clearance will result in noise abatement benefits where part of the IFR departure route does not conform to an FAA approved noise abatement route or altitude.
3. A pilot has requested a practice instrument approach and is not on an IFR flight plan.

All pilots receiving this authorization must comply with the VFR visibility and distance from cloud criteria in FAR Part 91. Use of the term does not relieve controllers of their responsibility to separate aircraft in TCAs/TRSAs as required by FAA Handbook 7110.65. When used as an ATC clearance/instruction, the term may be abbreviated "VFR;" e.g., "MAINTAIN VFR," "CLIMB/DESCEND VFR," etc.

VFR-ON-TOP— ATC authorization for an IFR aircraft to operate in VFR conditions at any appropriate VFR altitude (as specified in FAR and as restricted by ATC). A pilot receiving this authorization must comply with the VFR visibility, distance from cloud criteria, and the minimum IFR altitudes specified in FAR Part 91. The use of this term does not relieve controllers of their responsibility to separate aircraft in TCAs/TRSAs as required by FAA Handbook 7110.65.

VFR MILITARY TRAINING ROUTES (VR)— Routes used by the Department of Defense and associated Reserve and Air Guard units for the purpose of conducting low-altitude navigation and tactical training under VFR below 10,000 feet MSL at airspeeds in excess of 250 knots IAS.

VFR NOT RECOMMENDED— An advisory provided by a flight service station to a pilot during a preflight or inflight weather briefing that flight under visual flight rules is not recommended. To be given when the current and/or forecasted weather conditions are at or below VFR minimums. It does not abrogate the pilot's authority to make his own decision.

VIDEO MAP— An electronically displayed map on the radar display that may depict data such as airports, heliports, runway centerline extensions, hospital emergency landing areas, NAVAIDS and fixes, reporting points, airway/route centerlines, boundaries, handoff points, special use tracks, obstructions, prominent geographic features, map alignment indicators, range accuracy marks, minimum vectoring altitudes.

VISIBILITY— The ability, as determined by atmospheric conditions and expressed in units of distance, to see and identify prominent unlighted objects by day and prominent lighted objects by night. Visbility is reported as statute miles, hundreds of feet or meters. (Refer to FAR Part 91, AIM)

1. Flight Visibility—The average forward horizontal distance, from the cockpit of an aircraft in flight, at which prominent unlighted objects may be seen and identified by day and prominent lighted objects may be seen and identified by night.

ICAO—Flight Visibility—The visibility forward from the cockpit of an aircraft in flight.

2. Ground Visibility—Prevailing horizontal visibility near the earth's surface as reported by the United States National Weather Service or an accredited observer.

ICAO—Ground Visibility—The visibility at an aerodrome as reported by an accredited observer.

3. Prevailing Visibility—The greatest horizontal visibility equaled or exceeded throughout at least half the horizon circle which need not necessarily be continuous.
4. Runway Visibility Value/RVV—The visibility determined for a particular runway by a transmissometer. A meter provides a continuous indication of the visibility (reported in miles or fractions of miles) for the runway. RVV is used in lieu of prevailing visibility in determining minimums for a particular runway.
5. Runway Visual Range/RVR—An instrumentally derived value, based on standard calibrations, that represents the horizontal distance a pilot will see down the runway from the approach end. It is based on the sighting of either high intensity runway lights or on the visual contrast of other targets whichever yields the greater visual range. RVR, in contrast to prevailing or runway visibility, is based on what a pilot in a moving aircraft should see looking down the runway. RVR is horizontal visual range, not slant visual range. It is based on the measurement of a transmissometer made near the touchdown point of the instrument runway and is reported in hundreds of feet. RVR is used in lieu of RVV and/or prevailing visibility in determining minimums for a particular runway.
    a. Touchdown RVR—The RVR visibility readout values obtained from RVR equipment serving the runway touchdown zone.
    b. MID RVR—The RVR readout values obtained from RVR equipment located midfield of the runway.
    c. Rollout RVR—The RVR readout values obtained from RVR equipment located nearest the rollout end of the runway.

ICAO—Runway Visual Range—The maximum distance in the direction of takeoff or landing at which the runway or the specified lights or markers delineating it can be seen from a position above a specified point on its centerline at a height corresponding to the average eye-level of pilots at touchdown.

VISUAL APPROACH— An approach wherein an aircraft on an IFR flight plan, operating in VFR conditions under the control of an air traffic control facility and having an air traffic control authorization, may proceed to the airport of destination in VFR conditions.

ICAO—VISUAL APPROACH—An approach by an IFR flight when either part or all of an instrument approach procedure is not completed and the approach is executed in visual reference to terrain.

VISUAL APPROACH SLOPE INDICATOR— (See Airport Lighting)

VISUAL DESCENT POINT/VDP— A defined point on the final approach course of a nonprecision straight-in approach procedure from which normal descent from the MDA to the runway touchdown point may be commenced, provided the approach threshold of that runway, or approach lights, or other markings identifiable with the approach end of that runway are clearly visible to the pilot.

VISUAL FLIGHT RULES/VFR— Rules that govern the procedures for conducting flight under visual conditions. The term "VFR" is also used in the United States to indicate weather conditions that are equal to or greater than minimum VFR requirements. In addition, it is used by pilots and controllers to indicate type of flight plan. (See Instrument Flight Rules, Instrument Meteorological Conditions, Visual Meteorological Conditions) (Refer to FAR, Part 91 and AIM)

VISUAL HOLDING— The holding of aircraft at selected, prominent geographical fixes which can be easily recognized from the air. (See Hold, Holding Fixes)

VISUAL METEOROLOGICAL CONDITIONS/VMC— Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling equal to or better than specified minima. (See Instrument Flight Rules, Instrument Meteorological Conditions, Visual Flight Rules)

VISUAL SEPARATION— A means employed by ATC to separate aircraft in terminal areas. There are two ways to effect this separation:

1. The tower controller sees the aircraft involved and issues instructions, as necessary, to ensure that the aircraft avoid each other.
2. A pilot sees the other aircraft involved and upon instructions from the controller provides his own separation by maneuvering his aircraft as necessary to avoid it. This may involve following another aircraft or keeping it in sight until it is no longer a factor. (See See and Avoid) (Refer to FAR, Part 91)

VORTAC/VHF OMNIDIRECTIONAL RANGE/TACTICAL AIR NAVIGATION— A navigation aid providing VOR azimuth, TACAN azimuth, and TACAN distance measuring equipment (DME) at one site. (See Distance Measuring Equipment, Navigational Aid TACAN, VOR) (Refer to AIM)

VORTICES/WING TIP VORTICES— Circular patterns of air created by the movement of an airfoil through the air when generating lift. As an airfoil moves through the atmosphere in sustained flight, an area of area of low pressure is created above it. The air flowing from the high pressure area to the low pressure area around and about the tips of the airfoil tends to roll up into two rapidly rotating vortices, cylindrical in shape. These vortices are the most predominant parts of aircraft wake turbulence and their rotational force is dependent upon the wing loading, gross weight, and speed of the generating aircraft. The vortices from medium to heavy aircraft can be of extremely high velocity and hazardous to smaller aircraft. (See Aircraft Classes Wake Turbulence) (Refer to AIM)

VOR/VERY HIGH FREQUENCY OMNIDIRECTIONAL RANGE STATION— A ground-based electronic navigation aid transmitting very high frequency navigation signals, 360 degrees in azimuth, oriented from magnetic north. Used as the basis for navigation in the National Airspace System. The VOR periodically identifies itself by Morse Code and may have an additional voice identification feature. Voice features may be used by ATC or FSS for transmitting instructions/information to pilots. (See Navigational Aid) (Refer to AIM)

VOT/VOR TEST SIGNAL— A ground facility which emits a test signal to check VOR receiver accuracy. Some VOT's are available to the user while airborne, and others are limited to ground use only. (Refer to FAR, Part 91, AIM, Airport/Facility Directory)

WAKE TURBULENCE— Phenomena resulting from the passage of an aircraft through the atmosphere. The term includes vortices, thrust stream turbulence, jet blast, jet wash, propeller wash, and rotor wash both on the ground and in the air. (See Aircraft Classes, Jet Blast, Vortices) (Refer to AIM)

WARNING AREA— (See Special Use Airspace)

WAYPOINT— A predetermined geographical position used for route/instrument approach definition, or progress reporting purposes, that is defined relative to a VORTAC station or in terms of latitude/longitude coordinates.

WEATHER ADVISORY/INFLIGHT WEATHER ADVISORY— (See SIGMET, AIRMET)

WEATHER ADVISORY/WS/WST/WA/CWA— In aviation weather forecast practice, an expression of hazardous weather conditions not predicted in the area forecast, as they affect the operation of air traffic and as prepared by the NWS.

WHEN ABLE— When used in conjunction with ATC instructions, gives the pilot the latitude to delay compliance until a condition or event has been reconciled. Unlike "pilot discretion," when instructions are prefaced "when able," the pilot is expected to seek the first opportunity to comply. Once a maneuver has been initiated, the pilot is expected to continue until the specifications of the instructions have been met. "When able," should not be used when expeditious compliance is required.

WILCO— I have received your message, understand it, and will comply with it.

WIND SHEAR— A change in wind speed and/or wind direction in a short distance resulting in a tearing or shearing effect. It can exist in a horizontal or vertical direction and occasionally in both.

WORDS TWICE—

1. As a request: "Communication is difficult. Please say every phrase twice."
2. As information: "Since communications are difficult, every phrase in this message will be spoken twice."

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Airman's Information Manual

Official Guide to Basic Flight Information and ATC Procedures

December 18, 1986

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It is a pilot's inherent responsibility that he be alert at all times for and in anticipation of all circumstances, situations and conditions which affect the safe operation of his aircraft. For example, a pilot should expect to find air traffic at any time or place. At or near both civil and military airports and in the vicinity of known training areas, a pilot should expect concentrated air traffic although he should realize concentrations of air traffic are not limited to these places.

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AIRMAN'S INFORMATION MANUAL (AIM)

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This manual is designed to provide airmen with basic flight information and ATC procedures for use in the National Airspace System (NAS) of the United States. The information contained parallels the U.S. Aeronautical Information Publication (AIP) distributed internationally.

This manual contains the fundamentals required in order to fly in the U.S. NAS. It also contains items of interest to pilots concerning health and medical facts, factors affecting flight safety, a pilot/controller glossary of terms used in the Air Traffic Control System, and information on safety, accident and hazard reporting.

This manual is complemented by other operational publications which are available upon separate subscription. These publications are:

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DECEMBER 18, 1986

AIRMAN'S INFORMATION MANUAL

EXPLANATION OF MAJOR CHANGES

Para 165. c (3) TERMINAL RADAR PROGRAMS FOR VFR AIRCRAFT—Paragraph modified to delete reference to paragraph 166 and to indicate that TRSAs are depicted on sectional charts and listed in the Airport/Facility Directory.

Para 166. TERMINAL RADAR SERVICE AREAS (TRSAs)—Paragraph deleted, information is depicted on sectional charts and listed in the Airport/Facility Directory. As TRSAs are replaced by ARSAs, this paragraph frequently listed sites that had been converted between publishing cycles.

Para 167. c d TOWER EN ROUTE CONTROL (TEC)—Subparagraphs were modified to delete reference to pictorial and specific route descriptions published in the Airport/Facility Directory (AFD).

Para 171. HAZARDOUS AREA REPORTING SERVICE—Paragraph revised for currency.

Para 325. b INSTRUMENT DEPARTURES—Paragraph revised for clarity.

Para 384. CHARTED VISUAL FLIGHT PROCEDURES (CVFP)—Paragraph revised for clarity.

Para 503. a EN ROUTE FLIGHT ADVISORY SERVICE (EFAS)—Paragraph was modified to include information on High Altitude/En Route Flight Advisory Service, now being implemented in some areas of the country.

Para 510. WEATHER RADAR SERVICES—Paragraph was rewritten for currency.

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Chapter 1. NAVIGATION AIDS

Section 1. AIR NAVIGATION RADIO AIDS

1. GENERAL

Various types of air navigation aids are in use today, each serving a special purpose. These aids have varied owners and operators namely: the Federal Aviation Administration (FAA), the military services, private organizations, individual states and foreign governments. The FAA has the statutory authority to establish, operate, maintain air navigation facilities and to prescribe standards for the operation of any of these aids which are used for instrument flight in federally controlled airspace. These aids are tabulated in the Airport/Facility Directory.

2. NONDIRECTIONAL RADIO BEACON (NDB)

a. A low or medium frequency radio beacon transmits nondirectional signals whereby the pilot of an aircraft properly equipped can determine his bearing and "home" on the station. These facilities normally operate in the frequency band of 190 to 535 kHz and transmit a continuous carrier with either 400 or 1020 Hz modulation. All radio beacons except the compass locators transmit a continuous three-letter identification in code except during voice transmissions.

b. When a radio beacon is used in conjunction with the Instrument Landing System markers, it is called a Compass Locator.

c. Voice transmissions are made on radio beacons unless the letter "W" (without voice) is included in the class designator (HW).

d. Radio beacons are subject to disturbances that may result in erroneous bearing information. Such disturbances result from such factors as lightning, precipitation static, etc. At night radio beacons are vulnerable to interference from distant stations. Nearly all disturbances which affect the ADF bearing also affect the facility's identification. Noisy identification usually occurs when the ADF needle is erratic. Voice, music or erroneous identification may be heard when a steady false bearing is being displayed. Since ADF receivers do not have a "FLAG" to warn the pilot when erroneous bearing information is being displayed, the pilot should continuously monitor the NDB's identification.

3. VHF OMNI-DIRECTIONAL RANGE (VOR)

a. VORs operate within the 108.0 to 117.95 MHz frequency band and have a power output necessary to provide coverage within their assigned operational service volume. It is subject to line-of-sight restriction, and the range varies proportionally to the altitude of the receiving equipment. The normal service ranges for the various classes of VORs are given in PARA. 10.d.

b. Most VORs are equipped for voice transmission on the VOR frequency. VORs without voice capability are indicated by the letter "W" (without voice) included in the class designator (VORW).

c. The only positive method of identifying a VOR is by its Morse Code identification or by the recorded automatic voice identification which is always indicated by use of the word "VOR" following the range's name. Reliance on determining the identification of an omnirange should never be placed on listening to voice transmissions by the Flight Service Station (FSS) (or approach control facility) involved. Many FSSs remotely operate several omniranges with different names. In some cases, none of the VORs have the name of the "parent" FSS. During periods of maintenance, the facility may radiate a T-E-S-T code (— ● ●●● —) or the code may be removed.

d. Voice identification has been added to numerous VORs. The transmission consists of a voice announcement, "AIRVILLE VOR" alternating with the usual Morse Code identification.

e. The effectiveness of the VOR depends upon proper use and adjustment of both ground and airborne equipment.

(1) Accuracy: The accuracy of course alignment of the VOR is excellent, being generally plus or minus 1 degree.

(2) Roughness: On some VORs, minor course roughness may be observed, evidenced by course needle or brief flag alarm activity (some receivers are more susceptible to these irregularities than others). At a few stations, usually in mountainous terrain, the pilot may occasionally observe a brief course needle oscillation, similar to the indication of "approaching station." Pilots flying over unfamiliar routes are cautioned to be on the alert for these vagaries, and in particular, to use the "to/from" indicator to determine positive station passage.

(a) Certain propeller RPM settings or helicopter rotor speeds can cause the VOR Course Deviation Indicator to fluctuate as much as plus or minus six degrees. Slight changes to the RPM setting will normally smooth out this roughness. Pilots are urged to check for this modulation phenomenon prior to reporting a VOR station or aircraft equipment for unsatisfactory operation.

4. VOR RECEIVER CHECK

a. The FAA VOR test facility (VOT) transmits a test signal which provides users a convenient means to determine the operational status and accuracy of a VOR receiver while on the ground where a VOT is located. The airborne use of VOT is permitted; however, its use is strictly limited to those areas/altitudes specifically authorized in the Airport/Facility Directory or appropriate supplement.

b. To use the VOT service,tune in the VOT frequency on your VOR receiver. With the Course Deviation Indicator (CDI) centered, the omni-bearing selector should read 0 de-

grees with the to/from indication showing "from" or the omni-bearing selector should read 180 degrees with the to/from indication showing "to". Should the VOR receiver operate an RMI (Radio Magnetic Indicator), it will indicate 180 degrees on any OBS setting. Two means of identification are used. One is a series of dots and the other is a continuous tone. Information concerning an individual test signal can be obtained from the local FSS.

c. Periodic VOR receiver calibration is most important. If a receiver's Automatic Gain Control or modulation circuit deteriorates, it is possible for it to display acceptable accuracy and sensitivity close into the VOR or VOT and display out-of-tolerance readings when located at greater distances where weaker signal areas exist. The likelihood of this deterioration varies between receivers, and is generally considered a function of time. The best assurance of having an accurate receiver is periodic calibration. Yearly intervals are recommended at which time an authorized repair facility should recalibrate the receiver to the manufacturer's specifications.

d. Federal Aviation Regulations (FAR 91.25) provides for certain VOR equipment accuracy checks prior to flight under instrument flight rules. To comply with this requirement and to ensure satisfactory operation of the airborne system, the FAA has provided pilots with the following means of checking VOR receiver accuracy:

(1) VOT or a radiated test signal from an appropriately rated radio repair station.

(2) Certified airborne check points.

(3) Certified check points on the airport surface.

e. A radiated VOR test signal from an appropriately rated radio repair station serves the same purpose as an FAA VOR signal and the check is made in much the same manner as a VOT with the following differences:

(1) The frequency normally approved by the FCC is 108.0 MHz.

(2) Repair stations are not permitted to radiate the VOR test signal continuously; consequently, the owner or operator must make arrangements with the repair station to have the test signal transmitted. This service is not provided by all radio repair stations. The aircraft owner or operator must determine which repair station in his local area provides this service. A representative of the repair station must make an entry into the aircraft logbook or other permanent record certifying to the radial accuracy and the date of transmission. The owner, operator or representative of the repair station may accomplish the necessary checks in the aircraft and make a logbook entry stating the results. It is necessary to verify which test radial is being transmitted and whether you should get a "to" or "from" indication.

f. Airborne and ground check points consist of certified radials that should be received at specific points on the airport surface or over specific landmarks while airborne in the immediate vicinity of the airport.

(1) Should an error in excess of plus or minus 4 degrees be indicated through use of a ground check, or plus or minus 6 degrees using the airborne check, IFR flight shall not be attempted without first correcting the source of the error.

> *CAUTION:* No correction other than the correction card figures supplied by the manufacturer should be applied in making these VOR receiver checks.

(2) Locations of airborne check points, ground check points and VOTs are published in the Airport/Facility Directory.

(3) If a dual system VOR (units independent of each other except for the antenna) is installed in the aircraft one system may be checked against the other. Turn both systems to the same VOR ground facility and note the indicated bearing to that station. The maximum permissible variations between the two indicated bearings is 4 degrees.

5. TACTICAL AIR NAVIGATION (TACAN)

a. For reasons peculiar to military or naval operations (unusual siting conditions, the pitching and rolling of a naval vessel, etc.) the civil VOR/DME system of air navigation was considered unsuitable for military or naval use. A new navigational system, TACAN, was therefore developed by the military and naval forces to more readily lend itself to military and naval requirements. As a result, the FAA has been in the process of integrating TACAN facilities with the civil VOR/DME program. Although the theoretical, or technical principles of operation of TACAN equipment are quite different from those of VOR/DME facilities, the end result, as far as the navigating pilot is concerned, is the same. These integrated facilities are called VORTAC's.

b. TACAN ground equipment consists of either a fixed or mobile transmitting unit. The airborne unit in conjunction with the ground unit reduces the transmitted signal to a visual presentation of both azimuth and distance information. TACAN is a pulse system and operates in the UHF band of frequencies. Its use requires TACAN airborne equipment and does not operate through conventional VOR equipment.

6. VHF OMNI-DIRECTIONAL RANGE/TACTICAL AIR NAVIGATION (VORTAC)

a. A VORTAC is a facility consisting of two components, VOR and TACAN, which provides three individual services: VOR azimuth, TACAN azimuth and TACAN distance (DME) at one site. Although consisting of more than one component, incorporating more than one operating frequency, and using more than one antenna system, a VORTAC is considered to be a unified navigational aid. Both components of a VORTAC are envisioned as operating simultaneously and providing the three services at all times.

b. Transmitted signals of VOR and TACAN are each identified by three-letter code transmission and are interlocked so that pilots using VOR azimuth with TACAN distance can be assured that both signals being received are definitely from the same ground station. The frequency channels of the VOR and the TACAN at each VORTAC facility are "paired" in accordance with a national plan to simplify airborne operation.

7. DISTANCE MEASURING EQUIPMENT (DME)

a. In the operation of DME, paired pulses at a specific spacing are sent out from the aircraft (this is the interrogation) and are received at the ground station. The ground

station (transponder) then transmits paired pulses back to the aircraft at the same pulse spacing but on a different frequency. The time required for the round trip of this signal exchange is measured in the airborne DME unit and is translated into distance (Nautical Miles) from the aircraft to the ground station.

b. Operating on the line-of-sight principle, DME furnishes distance information with a very high degree of accuracy. Reliable signals may be received at distances up to 199 NM at line-of-sight altitude with an accuracy of better than 1/2 mile or 3 percent of the distance, whichever is greater. Distance information received from DME equipment is SLANT RANGE distance and not actual horizontal distance.

c. DME operates on frequencies in the UHF spectrum between 962 MHz and 1213 MHz. Aircraft equipped with TACAN equipment will receive distance information from a VORTAC automatically, while aircraft equipped with VOR must have a separate DME airborne unit.

d. VOR/DME, VORTAC, ILS/DME, and LOC/DME navigation facilities established by the FAA provide course and distance information from collocated components under a frequency pairing plan. Aircraft receiving equipment which provides for automatic DME selection assures reception of azimuth and distance information from a common source when designated VOR/DME, VORTAC, ILS/DME, and LOC/DME are selected.

e. Due to the limited number of available frequencies, assignment of paired frequencies is required for certain military noncollocated VOR and TACAN facilities which serve the same area but which may be separated by distances up to a few miles. The military is presently undergoing a program to collocate VOR and TACAN facilities or to assign nonpaired frequencies to those that cannot be collocated.

f. VOR/DME, VORTAC, ILS/DME, and LOC/DME facilities are identified by synchronized identifications which are transmitted on a time share basis. The VOR or localizer portion of the facility is identified by a coded tone modulated at 1020 Hz or a combination of code and voice. The TACAN or DME is identified by a coded tone modulated at 1350 Hz. The DME or TACAN coded identification is transmitted one time for each three or four times that the VOR or localizer coded identification is transmitted. When either the VOR or the DME is inoperative, it is important to recognize which identifier is retained for the operative facility. A single coded identification with a repetition interval of approximately 30 seconds indicates that the DME is operative.

g. Aircraft equipment which provides for automatic DME selection assures reception of azimuth and distance information from a common source when designated VOR/DME, VORTAC and ILS/DME navigation facilities are selected. Pilots are cautioned to disregard any distance displays from automatically selected DME equipment when VOR or ILS facilities, which do not have the DME feature installed, are being used for position determination.

8—9. RESERVED

10. NAVAID SERVICE VOLUMES

a. Most air navigation radio aids which provide positive course guidance have a designated standard service volume (SSV). The SSV defines the reception limits of unrestricted NAVAIDS which are usable for random/unpublished route navigation.

b. A NAVAID will be classified as restricted if it does not conform to flight inspection signal strength and course quality standards throughout the published SSV. However, the NAVAID should not be considered usable at altitudes below that which could be flown while operating under random route IFR conditions (FAR 91.119), even though these altitudes may lie within the designated SSV. Service volume restrictions are first published in the Notices to Airman (NOTAM) and then with the alphabetical listing of the NAVAID's in the Airport/Facility Directory.

c. Standard Service Volume limitations do not apply to published IFR routes or procedures.

d. VOR/DME/TACAN STANDARD SERVICE VOLUMES (SSV)

Standard service volumes (SSVs) are graphically shown in Figures 10-1 through 10-5. The SSV of a station is indicated by using the class designator as a prefix to the station type designation.

EXAMPLE:

TVOR, LDME, and HVORTAC.

Within 25 NM, the bottom of the T service volume is defined by the curve in Figure 10-4. Within 40 NM, the bottoms of the L and H service volumes are defined by the curve in Figure 10-5.

SSV CLASS DESIGNATOR	ALTITUDE AND RANGE BOUNDARIES
T (Terminal)	From 1000 feet above ground level (AGL) up to and including 12,000 feet AGL at radial distances out to 25 NM. See Figures 10-3 and 10-4.
L (Low Altitude)	From 1000 feet AGL up to and including 18,000 feet AGL at radial distances out to 40 NM. See Figures 10-2 and 10-5.
H (High Altitude)	From 1000 feet AGL up to and including 14,500 feet AGL at radial distances out to 40 NM. From 14,500 feet AGL up to and including 60,000 feet at radial distances out to 100 NM. From 18,000 feet AGL up to and including 45,000 feet AGL at radial distances out to 130 NM. See Figures 10-1 and 10-5.

FIGURE 10-1. STANDARD HIGH ALTITUDE SERVICE VOLUME

(refer to FIGURE 5 for altitudes below 1000 feet)

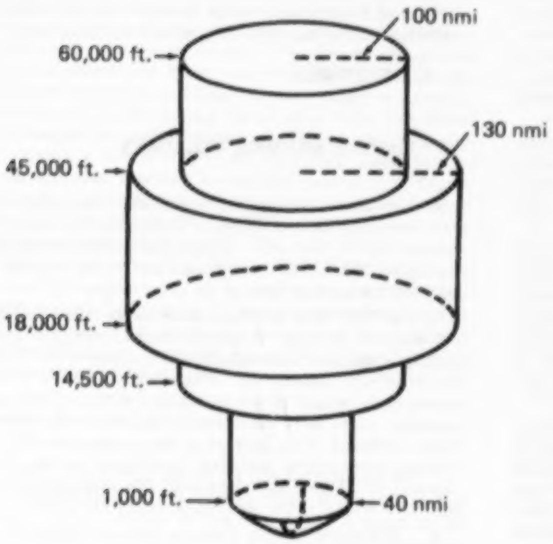
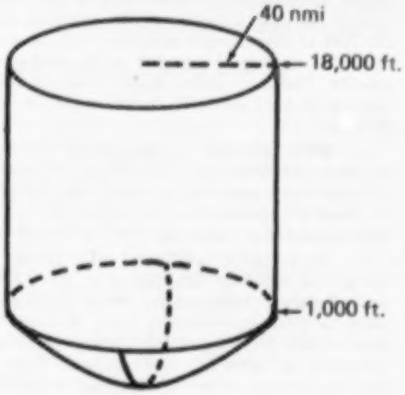

100 nmi
60,000 ft.
130 nmi
45,000 ft.
18,000 ft.
14,500 ft.
1,000 ft.
40 nmi

FIGURE 10-2. STANDARD LOW ALTITUDE SERVICE VOLUME

(refer to FIGURE 5 for altitudes below 1000 feet)


40 nmi
18,000 ft.
1,000 ft.

NOTE: All elevations shown are with respect to the station's site elevation (AGL). Coverage is not available in a cone of airspace directly above the facility.

FIGURE 10-3. STANDARD TERMINAL SERVICE VOLUME

(refer to FIGURE 4 for altitudes below 1000 feet)

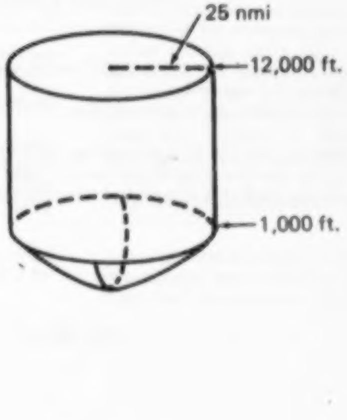

25 nmi
12,000 ft.
1,000 ft.

FIGURE 10-4. DEFINITION OF THE LOWER EDGE OF THE STANDARD T (TERMINAL) SERVICE VOLUME

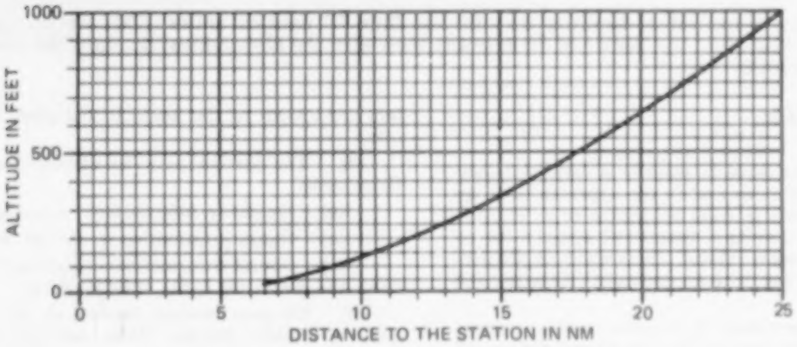
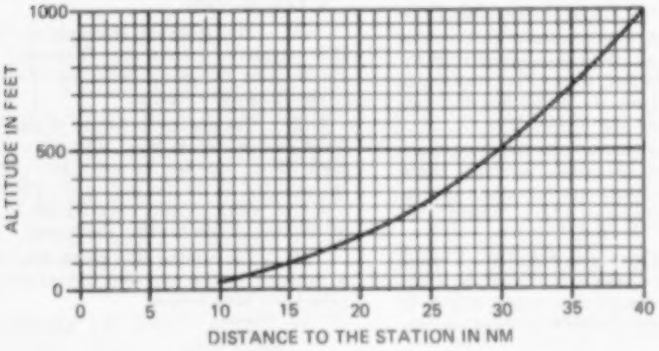


FIGURE 10-5. DEFINITION OF THE LOWER EDGE OF THE STANDARD H (HIGH) AND L (LOW) SERVICE VOLUMES



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e. NONDIRECTIONAL RADIO BEACON (NDB)

NDBs are classified according to their intended use. The ranges of NDB service volumes are shown below. The distances (radius) are the same at all altitudes.

CLASS	DISTANCE (RADIUS)
Compass Locator	15 NM
MH	25 NM
H	50 NM*

CLASS	DISTANCE (RADIUS)
HH	75 NM

* Service ranges of individual facilities may be less than 50 nautical miles (NM). Restrictions to service volumes are first published in the Notice to Airmen and then with the alphabetical listing of the NAVAID in the Airport/Facility Directory.

11. MARKER BEACON

a. Marker beacons serve to identify a particular location in space along an airway or on the approach to an instrument runway. This is done by means of a 75 MHz transmitter which transmits a directional signal to be received by aircraft flying overhead. These markers are generally used in conjunction with en route NAVAIDs and ILS as point designators.

b. There are three classes of en route marker beacons: Fan Marker (FM), Low Powered Fan Markers (LFM) and Z Markers. They transmit the letter "R" (dot dash dot) identification, or (if additional markers are in the same area) the letter "K," "P," "X," or "Z."

(1) Class FMs are used to provide a positive identification of positions at definite points along the airways. The transmitters have a power output of approximately 100 watts. Two types of antenna array are used with class FMs.

(a) The first type used, and generally referred to as the standard type, produces an elliptical shaped pattern, which, at an elevation of 1,000 feet above the station, is about 4 NM wide and 12 NM long. At 10,000 feet the pattern widens to about 12 NM wide and 35 NM long.

(b) The second array produces a dumbbell or boneshaped pattern, which, at the "handle", is about three miles wide at 1,000 feet. The boneshaped marker is preferred at approach control locations where "timed" approaches are used.

(2) The class LFM or low powered FMs have a rated power output of 5 watts. The antenna array produces a circular pattern which appears elongated at right angles to the airway due to the directional characteristics of the aircraft receiving antenna.

(3) The Station Location, or Z-Marker, was developed to meet the need for a positive position indicator for aircraft operating under instrument flight conditions to show the pilot when he was passing directly over a low frequency navigational aid. The marker consists of a 5 watt transmitter and a directional antenna array which is located on the range plot between the towers or the loop antennas.

NOTE— ILS marker beacon information is included in PARA. 12 - INSTRUMENT LANDING SYSTEMS (ILS).

12. INSTRUMENT LANDING SYSTEM (ILS)

a. GENERAL

(1) The ILS is designed to provide an approach path for exact alignment and descent of an aircraft on final approach to a runway.

(2) The ground equipment consists of two highly directional transmitting systems and, along the approach, three (or fewer) marker beacons. The directional transmitters are known as the localizer and glide slope transmitters.

(3) The system may be divided functionally into three parts:

(a) **Guidance information** — localizer, glide slope

(b) **Range information** — marker beacon, DME

(c) **Visual information** — approach lights, touchdown and centerline lights, runway lights

(4) Compass locators located at the Outer Marker (OM) or Middle Marker (MM) may be substituted for marker beacons. DME, when specified in the procedure, may be substituted for the OM.

(5) Where a complete ILS system is installed on each end of a runway; (i.e. the approach end of Runway 4 and the approach end of Runway 22) the ILS systems are not in service simultaneously.

b. LOCALIZER

(1) The localizer transmitter operates on one of 40 ILS channels within the frequency range of 108.10 to 111.95 MHz. Signals provide the pilot with course guidance to the runway centerline.

(2) The approach course of the localizer is called the front course and is used with other functional parts, e.g., glide slope, marker beacons, etc. The localizer signal is transmitted at the far end of the runway. It is adjusted for a course width of (full scale fly-left to a full scale fly-right) of 700 feet at the runway threshold.

(3) The course line along the extended centerline of a runway, in the opposite direction to the front course is called the back course.

> *CAUTION:* Unless the aircraft's ILS equipment includes reverse sensing capability, when flying inbound on the back course it is necessary to steer the aircraft in the direction opposite the needle deflection when making corrections from off-course to on-course. This "flying away from the needle" is also required when flying outbound on the front course of the localizer. DO NOT USE BACK COURSE SIGNALS for approach unless a BACK COURSE APPROACH PROCEDURE is published for that particular runway and the approach is authorized by ATC.

(4) Identification is in International Morse Code and consists of a three-letter identifier preceded by the letter I (..) transmitted on the localizer frequency.

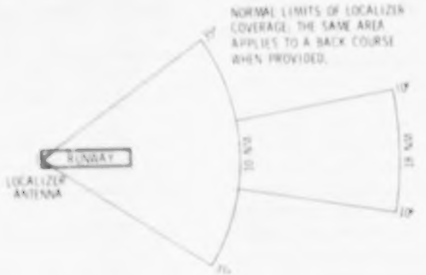
EXAMPLE:

I-DIA

(5) The localizer provides course guidance throughout the descent path to the runway threshold from a distance of 18 NM from the antenna between an altitude of 1,000 feet above the highest terrain along the course line and 4,500 feet above the elevation of the antenna site. Proper off-course indications are provided throughout the following angular areas of the operational service volume:

(a) To 10 degrees either side of the course along a radius of 18 NM from the antenna, and

(b) From 10 to 35 degrees either side of the course along a radius of 10 NM.


NORMAL LIMITS OF LOCALIZER COVERAGE: THE SAME AREA APPLIES TO A BACK COURSE WHEN PROVIDED.
35°
10°
10 NM
18 NM
10°
35°
RUNWAY
LOCALIZER ANTENNA

(c) Unreliable signals may be received outside these areas.

c. LOCALIZER—TYPE DIRECTIONAL AID

(1) The Localizer-type Directional Aid (LDA) is of comparable use and accuracy to a localizer but is not part of a complete ILS. The LDA course usually provides a more precise approach course than the similar Simplified Directional Facility (SDF) installation, which may have a course width of 6 or 12 degrees. The LDA is not aligned with the runway. Straight-in minimums may be published where alignment does not exceed 30 degrees between the course and runway. Circling minimums only are published where this alignment exceeds 30 degrees.

d. GLIDE SLOPE/GLIDE PATH

(1) The UHF glide slope transmitter, operating on one of the 40 ILS channels within the frequency range 329.15 MHz, to 335.00 MHz radiates its signals in the direction of the localizer front course. The term "glide path" means that portion of the glide slope that intersects the localizer.

> *CAUTION:* False glide slope signals may exist in the area of the localizer back course approach which can cause the glide slope flag alarm to disappear and present unreliable glide slope information. Disregard all glide slope signal indications when making a localizer back course approach unless a glide slope is specified on the approach and landing chart.

(2) The glide slope transmitter is located between 750 feet and 1,250 feet from the approach end of the runway (down the runway) and offset 250 to 650 feet from the runway centerline. It transmits a glide path beam 1.4 degrees wide. The signal provides descent information for navigation down to the lowest authorized decision height (DH) specified in the approved ILS approach procedure. The glidepath may not be suitable for navigation below the lowest authorized DH and any reference to glidepath indications below that height must be supplemented by visual reference to the runway environment. Glidepaths with no published DH are usable to runway threshold.

(3) The glide path projection angle is normally adjusted to 3 degrees above horizontal so that it intersects the MM at about 200 feet and the OM at about 1,400 feet above the runway elevation. The glide slope is normally usable to the distance of 10 NM. However, at some locations, the glide slope has been certified for an extended service volume which exceeds 10 NM.

(4) Pilots must be alert when approaching the glidepath interception. False courses and reverse sensing will occur at angles considerably greater than the published path.

(5) Make every effort to remain on the indicated glide path (reference: FAR 91.87(d)(2)). Exercise caution: avoid flying below the glide path to assure obstacle/terrain clearance is maintained.

(6) The published glide slope threshold crossing height (TCH)*DOES NOT* represent the height of the actual glide path on course indication above the runway threshold. It is used as a reference for planning purposes which represents the height above the runway threshold that an aircraft's glide slope antenna should be, if that aircraft remains on a trajectory formed by the four-mile-to-middle marker glidepath segment.

(7) Pilots must be aware of the vertical height between the aircraft's glide slope antenna and the main gear in the landing configuration and, at the DH, plan to adjust the descent angle accordingly if the published TCH indicates the wheel crossing height over the runway threshold may not be satisfactory. Tests indicate a comfortable wheel crossing height is approximately 20 to 30 feet, depending on the type of aircraft.

e. DISTANCE MEASURING EQUIPMENT (DME)

(1) When installed with the ILS and specified in the approach procedure, DME may be used:

(a) In lieu of the OM.

(b) As a back course (BC) final approach fix (FAF).

(c) To establish other fixes on the localizer course.

(2) In some cases, DME from a separate facility may be used within Terminal Instrument Procedures (TERPS) limitations:

(a) To provide ARC initial approach segments.

(b) As a FAF for BC approaches.

(c) As a substitute for the OM.

f. MARKER BEACON

(1) ILS marker beacons have a rated power output of 3 watts or less and an antenna array designed to produce a elliptical pattern with dimensions, at 1,000 feet above the antenna, of approximately 2,400 feet in width and 4,200 feet in length. Airborne marker beacon receivers with a selective sensitivity feature should always be operated in the "low" sensitivity position for proper reception of ILS marker beacons.

(2) Ordinarily, there are two marker beacons associated with an ILS, the OM and MM. Locatons with a Category II and III ILS also have an inner marker (IM). When an aircraft passes over a marker, the pilot will receive the following indications:

MARKER	CODE	LIGHT
OM	— — —	BLUE
MM	○ — ○ —	AMBER
IM	○ ○ ○ ○	WHITE
BC	○ ○ ○ ○	WHITE

(a) The OM normally indicates a position at which an aircraft at the appropriate altitude on the localizer course will intercept the ILS glide path.

(b) The MM indicates a position approximately 3,500 feet from the landing threshold. This is also the position where an aircraft on the glide path will be at an altitude of approximately 200 feet above the elevation of the touchdown zone.

(c) The inner marker (IM) will indicate a point at which an aircraft is at a designated decision height (DH) on the glide path between the MM and landing threshold.

(3) A back course marker normally indicates the ILS back course final approach fix where approach descent is commenced.

g. COMPASS LOCATOR

(1) Compass locator transmitters are often situated at the MM and OM sites. The transmitters have a power of less than 25 watts, a range of at least 15 miles and operate between 190 and 535 kHz. At some locations, higher powered radio beacons, up to 400 watts, are used as OM compass locators. These generally carry Transcribed Weather Broadcast (TWEB) information.

(2) Compass locators transmit two letter identification groups. The outer locator transmits the first two letters of the localizer identification group, and the middle locator transmits the last two letters of the localizer identification group.

h. ILS FREQUENCY

(1) The following frequency pairs are allocated for ILS.

Localizer MHz	Glide Slope
108.10	334.70
108.15	334.55
108.3	334.10
108.35	333.95
108.5	329.90
108.55	329.75
108.7	330.50
108.75	330.35
108.9	329.30
108.95	329.15
109.1	331.40
109.15	331.25
109.3	332.00
109.35	331.85
109.50	332.60
109.55	332.45
109.70	333.20
109.75	333.05
109.90	333.80
109.95	333.65
110.1	334.40
110.15	334.25
110.3	335.00
110.35	334.85
110.5	329.60
110.55	329.45
110.70	330.20
110.75	330.05
110.90	330.80
110.95	330.65
111.10	331.70
111.15	331.55
111.30	332.30
111.35	332.15
111.50	332.9
111.55	332.75
111.70	333.5
111.75	333.35
111.90	331.1
111.95	330.95

i. ILS MINIMUMS

(1) The lowest authorized ILS minimums, with all required ground and airborne systems components operative, are

(a) Category I - Decision Height (DH) 200 feet and Runway Visual Range (RVR) 2,400 feet (with touchdown zone and centerline lighting, RVR 1800 Category A, B, C; RVR 2000 Category D).

(b) Category II - DH 100 feet and RVR 1,200 feet.

(c) Category IIIA - RVR 700 feet.

NOTE— Special authorization and equipment are required for Category II and IIIA.

j. INOPERATIVE ILS COMPONENTS

(1) Inoperative localizer: When the localizer fails, an ILS approach is not authorized.

(2) Inoperative glide slope: When the glide slope fails, the ILS reverts to a nonprecision localizer approach.

NOTE— Refer to the Inoperative Component Table in the U.S. Government IAPs publications, Supplementary Information Section, for adjustments to minimums due to inoperative airborne or ground system equipment.

k. ILS COURSE DISTORTION

(1) All pilots should be aware that disturbances to ILS localizer and glide slope courses may occur when surface vehicles or aircraft are operated near the localizer or glide slope antennas. Most ILS installations are subject to signal interference by either surface vehicles, aircraft or both. ILS CRITICAL AREAS are established near each localizer and glide slope antenna.

(2) ATC issues control instructions to avoid interfering operations within ILS critical areas at controlled airports during the hours the Airport Traffic Control Tower (ATCT) is in operations as follows:

(a) Weather Conditions - Less than ceiling 800 feet and/or visibility 2 miles.

(i) LOCALIZER CRITICAL AREA - Except for aircraft that land, exit a runway, depart or miss approach, vehicles and aircraft are not authorized in or over the critical area when an arriving aircraft is between the ILS final approach fix and the airport. Additionally, when the ceiling is less than 200 feet and/or the visibility is RVR 2,000 or less, vehicle and aircraft operations in or over the area are not authorized when an arriving aircraft is inside the ILS MM.

(ii) GLIDE SLOPE CRITICAL AREA - Vehicles and aircraft are not authorized in the area when an arriving aircraft is between the ILS final approach fix and the airport unless the aircraft has reported the airport in sight and is circling or side stepping to land on a runway other than the ILS runway.

(3) Aircraft holding below 5000 feet between the outer marker and the airport may cause localizer signal variations for aircraft conducting the ILS Approach. Accordingly, such holding is not authorized when weather or visibility conditions are less than ceiling 800 feet and/or visibility 2 miles.

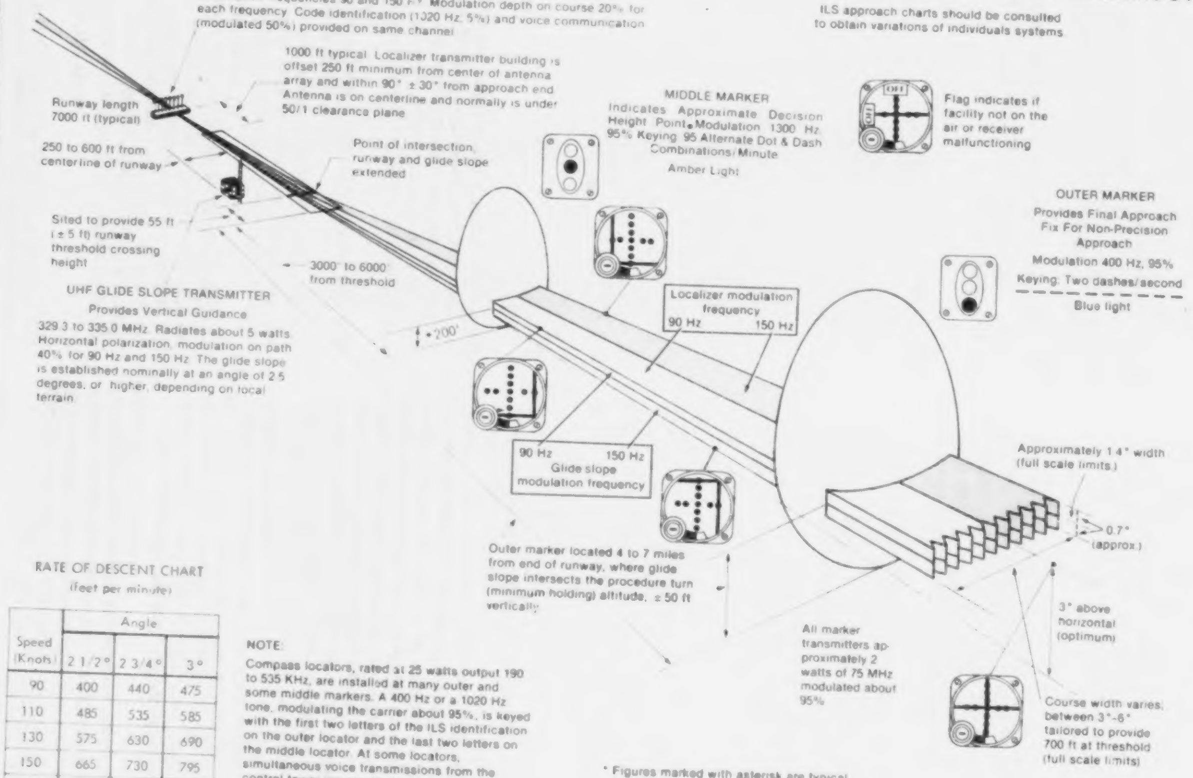
(4) Pilots are cautioned that vehicular traffic not subject to ATC may cause momentary deviation to ILS course or glide slope signals. Also, critical areas are not protected at uncontrolled airports or at airports with an operating control tower when weather or visibility conditions are above those requiring protective measures. Aircraft conducting coupled or autoland operations should be especially alert in monitoring automatic flight control systems.

ILS

[FAA INSTRUMENT LANDING SYSTEM]

STANDARD CHARACTERISTICS AND TERMINOLOGY

ILS approach charts should be consulted to obtain variations of individuals systems



VHF LOCALIZER

Provides Horizontal Guidance

108.10 to 111.95 MHz. Radiates about 100 watts. Horizontal polarization. Modulation frequencies 90 and 150 Hz. Modulation depth on course 20% for each frequency. Code identification (1020 Hz, 5%) and voice communication (modulated 50%) provided on same channel

1000 ft typical. Localizer transmitter building is offset 250 ft minimum from center of antenna array and within 90° ± 30° from approach end. Antenna is on centerline and normally is under 50/1 clearance plane

Runway length 7000 ft (typical)

250 to 600 ft from centerline of runway

Sited to provide 55 ft (± 5 ft) runway threshold crossing height

Point of intersection, runway and glide slope extended

3000' to 6000' from threshold

UHF GLIDE SLOPE TRANSMITTER

Provides Vertical Guidance

329.3 to 335.0 MHz. Radiates about 5 watts. Horizontal polarization, modulation on path 40% for 90 Hz and 150 Hz. The glide slope is established nominally at an angle of 2.5 degrees, or higher, depending on local terrain

MIDDLE MARKER

Indicates Approximate Decision Height Point. Modulation 1300 Hz 95% Keying 95 Alternate Dot & Dash Combinations/Minute

Amber Light

Flag indicates if facility not on the air or receiver malfunctioning

OUTER MARKER

Provides Final Approach Fix For Non-Precision Approach

Modulation 400 Hz, 95%

Keying: Two dashes/second

— — — — — — — — — —

Blue light

Outer marker located 4 to 7 miles from end of runway, where glide slope intersects the procedure turn (minimum holding) altitude, ± 50 ft vertically

All marker transmitters approximately 2 watts of 75 MHz modulated about 95%

Approximately 1.4° width (full scale limits)

3° above horizontal (optimum)

Course width varies; between 3°-6° tailored to provide 700 ft at threshold (full scale limits)

*200'
Localizer modulation frequency
90 Hz
150 Hz
90 Hz
150 Hz
Glide slope modulation frequency
0.7° (approx.)
OFF
OFF

RATE OF DESCENT CHART

(feet per minute)

Speed (Knots)	Angle		
	2 1/2°	2 3/4°	3°
90	400	440	475
110	485	535	585
130	575	630	690
150	665	730	795
160	707	778	849

NOTE:

Compass locators, rated at 25 watts output 190 to 535 KHz, are installed at many outer and some middle markers. A 400 Hz or a 1020 Hz tone, modulating the carrier about 95%, is keyed with the first two letters of the ILS identification on the outer locator and the last two letters on the middle locator. At some locators, simultaneous voice transmissions from the control tower are provided, with appropriate reduction in identification percentage

* Figures marked with asterisk are typical. Actual figures vary with deviations in distances to markers, glide angles and localizer widths.

(b) Weather Conditions - At or above ceiling 800 feet and/or visibility 2 miles.

(i) No critical area protective action is provided under these conditions

(ii) If an aircraft advises the TOWER that an AUTOLAND or COUPLED approach will be conducted, an advisory will be promptly issued if a vehicle or aircraft will be in or over a critical area when the arriving aircraft is inside the ILS MM.

EXAMPLE:

GLIDE SLOPE SIGNAL NOT PROTECTED.

13. SIMPLIFIED DIRECTIONAL FACILITY (SDF)

a. The SDF provides a final approach course similar to that of the ILS localizer. It does not provide glide slope information. A clear understanding of the ILS localizer and the additional factors listed below completely describe the operational characteristics and use of the SDF.

b. The SDF transmits signals within the range of 108.10 to 111.95 MHz.

c. The approach techniques and procedures used in an SDF instrument approach are essentially the same as those employed in executing a standard localizer approach except the SDF course may not be aligned with the runway and the course may be wider, resulting in less precision.

d. Usable off-course indications are limited to 35 degrees either side of the course centerline. Instrument indications received beyond 35 degrees should be disregarded.

e. The SDF antenna may be offset from the runway centerline. Because of this, the angle of convergence between the final approach course and the runway bearing should be determined by reference to the instrument approach procedure chart. This angle is generally not more than 3 degrees. However, it should be noted that inasmuch as the approach course originates at the antenna site, an approach which is continued beyond the runway threshold will lead the aircraft to the SDF offset position rather than along the runway centerline.

f. The SDF signal is fixed at either 6 degrees or 12 degrees as necessary to provide maximum flyability and optimum course quality.

g. Identification consists of a three-letter identifier transmitted in Morse Code on the SDF frequency. The appropriate instrument approach chart will indicate the identifier used at a particular airport.

14. MICROWAVE LANDING SYSTEM (MLS)

a. GENERAL

(1) The MLS provides precision navigation guidance for exact alignment and descent of aircraft on approach to a runway. It provides azimuth, elevation, and distance.

(2) Both lateral and vertical guidance may be displayed on conventional course deviation indicators or incorporated into multipurpose cockpit displays. Range information can be displayed by conventional DME indicators and also incorporated into multipurpose displays.

(3) The MLS initially supplements and will eventually replace ILS as the standard landing system in the United States for civil, military and international civil aviation. The transition plan assures duplicate ILS and MLS facilities where needed to protect current users of ILS. At international airports ILS service is protected to the year 1995.

(4) The system may be divided into five functions:

(a) Approach azimuth.

(b) Back azimuth.

(c) Approach elevation.

(d) Range.

(e) Data communications.

(5) The *standard configuration* of MLS ground equipment includes:

(a) An azimuth station to perform functions (a) and (e) above. In addition to providing azimuth navigation guidance, the station transmits basic data which consists of information associated directly with the operation of the landing system, as well as advisory data on the performance of the ground equipment.

(b) An elevation station to perform function (c).

(c) Precision Distance Measuring Equipment (DME/P) to perform function (d). The DME/P provides continuous range information that is compatible with standard navigation DME but has improved accuracy and additional channel capabilities.

(6) MLS Expansion Capabilities — The standard configuration can be expanded by adding one or more of the following functions or characteristics.

(a) Back azimuth — Provides lateral guidance for missed approach and departure navigation.

(b) Auxiliary data transmissions — Provides *additional* data, including refined airborne positioning, meteorological information, runway status, and other supplementary information.

(c) Larger proportional guidance.

(7) MLS identification is a four-letter designation starting with the letter M. It is transmitted in International Morse Code at least six times per minute by the approach azimuth (and back azimuth) ground equipment.

b. APPROACH AZIMUTH GUIDANCE

(1) The azimuth station transmits MLS angle and data on one of 200 channels within the frequency range of 5031 to 5091 MHz. See Table 1 (page C1-S1-14) for MLS angle and data channeling, and Table 2 (page C1-S1-15) for the DME.

(2) The equipment is normally located about 1,000 feet beyond the stop end of the runway, but there is considerable flexibility in selecting sites. For example, for heliport operations the azimuth transmitter can be collocated with the elevation transmitter.

(3) The azimuth coverage (see Figure 1 page C1-S1-16) extends:

(a) Laterally, at least 40 degrees on either side of the runway.

(b) In elevation, up to an angle of 15 degrees — and to at least 20,000 feet.

(c) In range, to at least 20 NM.

c. BACK AZIMUTH GUIDANCE (See Figure 1 page C1-S1-16).

(1) The back azimuth transmitter is essentially the same as the approach azimuth transmitter. However, the equipment transmits at a somewhat lower data rate because the guidance accuracy requirements are not as stringent as for the landing approach. The equipment operates on the same frequency as the approach azimuth but at a different time in the transmission sequence.

(2) The equipment is normally located about 1,000 feet in front of the approach end of the runway. On runways that have MLS service on both ends (e.g., Runway 9 and 27), the azimuth equipment can be switched in their operation from the approach azimuth to the back azimuth and vice versa, and thereby reduce the amount of equipment required.

(3) The back azimuth provides coverage as follows:

(a) Laterally, at least 40 degrees on either side of the runway centerline.

(b) In elevation, up to an angle of 15 degrees.

(c) In range, to at least 7 NM from the runway stop end.

NOTE— The actual coverage is normally the same as for the approach azimuth.

d. ELEVATION GUIDANCE (See Figure 1)

(1) The elevation station transmits signals on the same frequency as the azimuth station. A single frequency is time-shared between angle and data functions.

(2) The elevation transmitter is normally located about 400 feet from the side of the runway between runway threshold and the touchdown zone.

(3) Elevation coverage is provided in the same airspace as the azimuth guidance signals:

(a) In elevation, to at least +15 degrees.

(b) Laterally, 40 degrees on either side of the runway centerline.

(c) In range, to at least 20 NM.

e. RANGE GUIDANCE

(1) The MLS Precision Distance Measuring Equipment (DME/P) functions the same as the navigation DME described in PARA. 7, but there are some technical differences. The beacon transponder operates in the frequency band 962 to 1105 MHz and responds to an aircraft interrogator. The MLS DME/P accuracy is improved to be consistent with the accuracy provided by the MLS azimuth and elevation stations.

(2) A DME/P channel is paired with the azimuth and elevation channel. A complete listing of the 200 paired channels of the DME/P with the angle functions is contained in FAA Standard 022 (MLS Interoperability and Performance Requirements). For illustrative purposes the first page is shown in Table 2.

(3) The DME/P is an integral part of the MLS and is installed at all MLS facilities unless a waiver is obtained. This occurs infrequently — and only at outlying, low density airports where marker beacons or compass locators are already in place.

f. DATA COMMUNICATIONS

(1) The data transmission can include both basic and auxiliary data words. All MLS facilities transmit basic data. In the future facilities at some airports, including most high density airports, will also transmit auxilary data.

(2) Coverage limits — MLS data are transmitted throughout the azimuth (and back azimuth when provided) coverage sectors.

(3) Basic data content — Representative data include:

(a) Station identification.

(b) Exact locations of azimuth, elevation and DME/P stations (for MLS receiver processing functions).

(c) Ground equipment performance level.

(d) DME/P channel and status.

(4) Auxiliary data content — Representative data include:

(a) 3-D locations of MLS equipment.

(b) Waypoint coordinates.

(c) Runway conditions.

(d) Weather (e.g., RVR, ceiling, altimeter setting, wind, wake vortex, wind shear).

g. Operational flexibility. The MLS has the capability to fulfill a variety of needs in the transition, approach, landing, missed approach and departure phases of flight. For example: Curved and segmented approaches; selectable glide path angles; accurate 3-D positioning of the aircraft in space; and the establishment of boundaries to ensure clearance from obstructions in the terminal area. While many of these capabilities are available to any MLS-equipped aircraft, the more sophisticated capabilities (such as curved and segmented approaches) are dependent upon the particular capabilities of the airborne equipment.

h. SUMMARY

(1) **Accuracy.** The MLS provides precision three-dimensional navigation guidance accurate enough for all approach and landing maneuvers.

(2) **Coverage.** Accuracy is consistent throughout the coverage volumes shown in Figure 1.

(3) **Environment.** The system has low susceptibility to interference from weather conditions and airport ground traffic.

(4) **Channels.** MLS has 200 channels — enough for any foreseeable need.

(5) **Data.** The MLS transmits ground-air data messages associated with the systems operation.

(6) **Range information.** Continuous range information is provided with an accuracy of about 100 feet.

Table 1. MLS Channeling

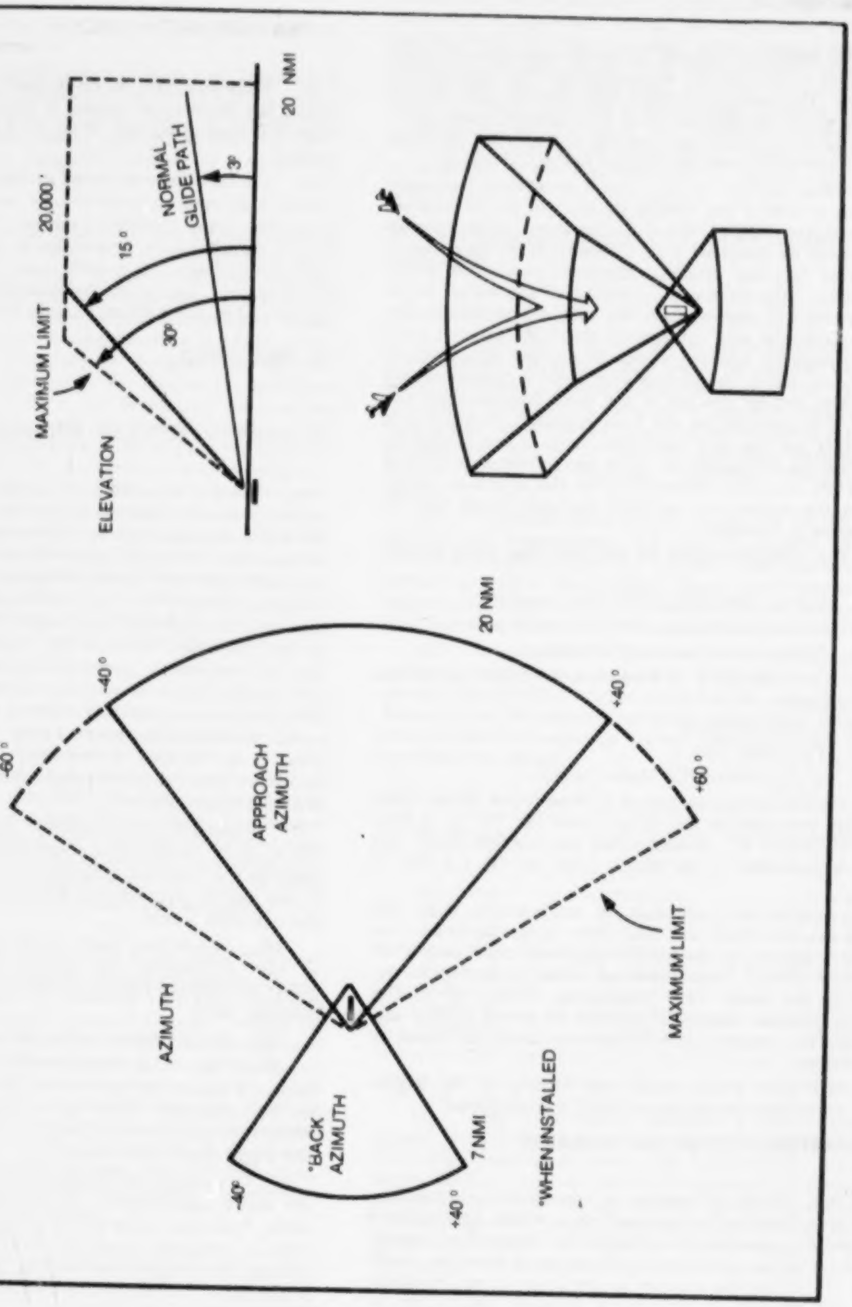
(Azimuth, Elevation, & Data)

CHANNEL NUMBER	FREQUENCY (MHz)	CHANNEL NUMBER	FREQUENCY (MHz)	CHANNEL NUMBER	FREQUENCY (MHz)	CHANNEL NUMBER	FREQUENCY (MHz)	CHANNEL NUMBER	FREQUENCY (MHz)
500	5031.0	540	5043.0	580	5055.0	620	5067.0	660	5079.0
501	5031.3	.	.	.	.	.	.	.	.
502	5031.6	.	.	.	.	.	.	.	.
503	5031.9	.	.	.	.	.	.	.	.
504	5032.2	.	.	.	.	.	.	.	.
505	5032.5	545	5044.5	585	5056.5	625	5068.5	665	5080.5
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
510	5034.0	550	5046.0	590	5058.0	630	5070.0	670	5082.0
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
515	5035.5	555	5047.5	595	5059.5	635	5071.5	675	5083.5
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
520	5037.0	560	5049.0	600	5061.0	640	5073.0	680	5085.0
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
525	5038.5	565	5050.5	605	5062.5	645	5074.5	685	5086.5
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
530	5040.0	570	5052.0	610	5064.0	650	5076.0	690	5088.0
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
535	5041.5	575	5053.5	615	5065.5	655	5077.5	695	5089.5
.	.	.	.	.	.	.	.	696	5089.8
.	.	.	.	.	.	.	.	697	5090.1
.	.	.	.	.	.	.	.	698	5090.4
.	.	.	.	.	.	.	.	699	5090.7

Table 2. **DME/P Channels, Frequencies, and Pairings**

DME CHANNEL (NUMBER)	VHF CHANNEL (MHz)	C-BAND CHANNEL (MHz)	ANGLE CHANNEL (NUMBER)	INTERROGATOR FREQUENCY (MHz)	NON-PRECISION INTERROGATOR PULSE CODE (USEC)	PRECISION INTERROGATOR PULSE CODE (USEC)	TRANSPONDER FREQUENCY (MHz)	TRANSPONDER PULSE CODE (USEC)
1X				1025	12		962	12
1Y				1025	36		1088	30
2X				1026	12		963	12
2Y				1026	36		1089	30
3X				1027	12		964	12
3Y				1027	36		1090	30
4X				1028	12		965	12
4Y				1028	36		1091	30
5X				1029	12		966	12
5Y				1029	36		1092	30
6X				1030	12		967	12
6Y				1030	36		1093	30
7X				1031	12		968	12
7Y				1031	36		1094	30
8X				1032	12		969	12
8Y				1032	36		1095	30
9X				1033	12		970	12
9Y				1033	36		1096	30
10X				1034	12		971	12
10Y				1034	36		1097	30
11X				1035	12		972	12
11Y				1035	36		1098	30
12X				1036	12		973	12
12Y				1036	36		1099	30
13X				1037	12		974	12
13Y				1037	36		1100	30
14X				1038	12		975	12
14Y				1038	36		1101	30
15X				1039	12		976	12
15Y				1039	36		1102	30
16X				1040	12		977	12
16Y				1040	36		1103	30
17X	108.00	-	-	1041	12	-	978	12
17Y	108.05	5043.00	540	1041	36	42	1104	30
17Z	-	5043.30	541	1041	21	27	1104	15
18X	108.10	5031.00	500	1042	12	18	979	12
18W	-	5031.30	501	1042	24	33	979	24
18Y	108.15	5043.60	542	1042	36	42	1105	30
18Z	-	5043.90	543	1042	21	27	1105	15
19X	108.20	-	-	1043	12	-	980	12

Figure 1.
COVERAGE VOLUMES


ELEVATION
MAXIMUM LIMIT
30°
15°
20,000'
NORMAL GLIDE PATH
3°
20 NMI
AZIMUTH
APPROACH AZIMUTH
-60°
-40°
20 NMI
+40°
+60°
MAXIMUM LIMIT
*BACK AZIMUTH
-40°
+40°
7 NMI
*WHEN INSTALLED

15. INTERIM STANDARD MICROWAVE LANDING SYSTEM (ISMLS)

a. The ISMLS is designed to provide approach information similar to the ILS for an aircraft on final approach to a runway. The system provides both lateral and vertical guidance which is displayed on a conventional course deviation indicator or approach horizon. Operational performance and coverage areas are similar to the ILS system.

b. ISMLS operates in the C-band microwave frequency range (about 5000 MHz). ISMLS signals will not be received by unmodified VHF/UHF ILS receivers. Aircraft with ISMLS must be equipped with a C-band receiving antenna in addition to other special equipment mentioned below. The C-band antenna limits reception of the signal to an angle of about 50 degrees from the inbound course. An aircraft so equipped will not receive the ISMLS signal until flying a magnetic heading within 50 degrees either side of the inbound course. Because of this, ISMLS procedures are designed to restrict the use of the ISMLS signal until the aircraft is in position for the final approach. Transition to the ISMLS, holding and procedure turns at the ISMLS facility must be predicated on other navigation aids such as NDB, VOR, etc. Once established on the approach course inbound, the system can be flown the same as an ILS. No back course is provided.

c. The ISMLS consists of the following basic components:

(1) C-Band (5000 MHz-5030 MHz) localizer.

(2) C-Band (5220 MHz-5250 MHz) glide path.

(3) VHF marker beacons (75 MHz).

(4) A VHF/UHF ILS receiver modified to recieve ISMLS signals.

(5) C-Band antenna.

(6) Converter unit.

(7) A Microwave/ILS Mode Control.

d. Identification consists of a three letter Morse Code identifier preceded by the Morse Code for "M" (- -) (e.g., M—STP). The "M" distinguishes this system from ILS which is preceded by the Morse Code for "I" (..) (e.g., I-STP).

e. Approaches published in conjunction with the ISMLS are identified as "MLS Rwy—(Interim)." The frequency displayed on the ISMLS approach chart is a VHF frequency. ISMLS frequencies are tuned by setting the receiver to the listed VHF frequencies. When the ISMLS mode is selected, receivers modified to accept ISMLS signals receive a paired C-band frequency that is processed by the receiver.

CAUTION: Pilots should not attempt to fly ISMLS procedures unless the aircraft is so equipped.

16. MAINTENANCE OF FAA NAVAIDS

During periods of routine or emergency maintenance, coded identification (or code and voice, where applicable) is removed from certain FAA NAVAIDs. Removal of identification serves as a warning to pilots that the facility is officially off the air for tune-up or repair and may be unreliable even though intermittent or constant signals are received.

NOTE- During periods of maintenance VHF ranges may ra ate a T-E-S-T code (— ● ●●● —).

17. NAVAIDS WITH VOICE

a. Voice equipped en route radio navigational aids a under the operational control of either an FAA FSS or a approach control facility. Most NAVAIDs are remotely o erated.

b. Unless otherwise noted on the chart, all radio nav gation aids operate continuously except during interru tions for voice transmissions on the same frequenci where simultaneous transmission is not available, a during shutdowns for maintenance. Hours of operation facilities not operating continuously are annotated charts and in the Airport/Facility Directory.

18. RESERVED

19. USER REPORTS ON NAVAID PERFORMANCE

a. Users of the National Airspace System (NAS) ca render valuable assistance in the early correction NAVAID malfunctions by reporting their observations undesirable NAVAID performance. Although NAVAID are monitored by electronic detectors, adverse effects electronic interference, new obstructions or changes in te rain near the NAVAID can exist without detection by th ground monitors. Some of the characteristics of malfun tion or deteriorating performance which should be reporte are: erratic course or bearing indications; intermittent, full, flag alarm; garbled, missing or obviously imprope coded identification; poor quality communications rece tion; or, in the case of frequency interference, an audib hum or tone accompanying radio communications NAVAID identification.

b. Reporters should identify the NAVAID, location the aircraft, time of the observation, type of aircraft an describe the condition observed; the type of receivers in u is also useful information. Reports can be made in any the following ways:

(1) Immediate report by direct radio communicati to the controlling Air Route Traffic Control Cent (ARTCC), Control Tower, or FSS. This method provides t quickest result.

(2) By telephone to the nearest FAA facility.

(3) By FAA Form 8000-7, Safety Improveme Report. This is a self addressed, postage-paid card design for this purpose. These cards may be obtained at FA FSSs, General Aviation District Offices and General Avi tion Fixed Base Operations.

c. In aircraft that have more than one receiver, the are many combinations of possible interference betwe units. This can cause either erroneous navigation indic tions or, complete or partial blanking out of the commu cations. Pilots should be familiar enough with the radio i stallation of the particular airplanes they fly to recogni this type of interferrence.

20. LORAN

a. LORAN-A service has been terminated in the U.S. coastal confluence region.

b. LORAN-C was developed to provide the Department of Defense with a radio navigation capability having longer range and much greater accuracy than its predecessor, LORAN-A. It was subsequently selected as the U.S. Government provided radio navigation system for civil marine use in the U.S. coastal areas.

c. Operation

LORAN-C is a pulsed, hyperbolic system, operating in the 90-110 kHz frequency band. The system is based upon measurement of the difference in time of arrival of pulses of radio-frequency energy radiated by a group, or chain of transmitters which are separated by hundreds of miles. Within a chain, one station is designated as the Master station (M), and the other stations are designated as Secondary stations, Whiskey (W), X-ray (X), Yankee (Y), and Zulu (Z). Signals transmitted from the Secondary stations are synchronized with those from the Master station. The measurement of a time-difference (TD) is made by a receiver that achieves accuracy by comparing a zero crossing of a specified radio- frequency cycle within the pulses received from the Master and Secondary stations of a chain. Only groundwave signals are used for air navigation in the National Airspace System. Within the groundwave range, LORAN-C will provide the user, who uses an adequate receiver, with predictable accuracy of 0.25 nautical miles (2 drms) or better. All accuracy is dependent on the user's location within the signal coverage area of the chain of stations.

d. Signal coverage

Expansion of the LORAN-C system to meet the requirement for the U.S. coastal waters of the conterminous 48 states and southern Alaska was completed in the late 1979. Stations have been built to provide service to the U.S. east and west coasts, the Gulf of Mexico, the Gulf of Alaska and Aleutians, and the Great Lakes. The coastal transmitters also provide inland coverage over about two-thirds of the area of the 48 states and over the southwestern portion of Alaska. Missing, from an aviation view point, is signal coverage over the mid-continent area.

e. Aviation uses

LORAN-C has been approved as an en route IFR navigation aid under provisions of Advisory Circular 20-121, "Airworthiness Approval of Airborne LORAN-C Systems for Use in the U.S. National Airspace System," August 23, 1984. The first LORAN-C guided nonprecision approach was made at Bedford, Massachussetts, on November 4, 1985, as part of an early implementation project established by the FAA in close cooperation with the National Association of State Aviation Officials. Until operational signal monitor receivers, similar in function to those used in the limited implementation project, are installed in exsting coverage areas, the number of approved nonprecision approach procedures will be limited.

f. Planned expansion

Current plans are to procure and install signal moniors in existing signal coverage areas with completion expected by mid-1988. The monitors will serve two functions: 1) they will provide immediate advisories on signal status to air traffic for use in granting approach clearances, and (2) they will be the source of calibration values that will be published on approach charts. The calibration values will remove most of the seasonal error that could cause LORAN-C accuracy to be worse than approach accuracy requirements. The mid-continent area will be provided with signal coverage after the planned installation of additional transmitters; completion of the installation is expected in 1989. In addition to the transmitters, signal monitors will be installed in the mid-continent to support nonprecision approaches.

21. OMEGA AND OMEGA/VLF NAVIGATION SYSTEMS

a. OMEGA

(1) OMEGA is a network of eight transmitting stations located throughout the world to provide worldwide signal coverage. These stations transmit in the Very Low Frequency (VLF) band. Because of the low frequency, the signals are receivable to ranges of thousands of miles. The stations are located in Norway, Liberia, Hawaii, North Dakota (USA), La Reunion, Argentina, Australia, and Japan.

(2) Presently each station transmits on four basic navigational frequencies: 10.2 kHz, 11.05 kHz, 11.3 kHz, and 13.6 kHz, in sequenced format. This time sequenced format prevents interstation signal interference. With eight stations and a silent .2-second interval between each transmission, the entire cycle repeats every 10 seconds.

(3) In addition to the four basic navigational frequencies, each station transmits a unique navigation frequency. An OMEGA station is said to be operating in full format when the station transmits on the basic frequencies plus the unique frequency. Unique frequencies are presently assigned as follows:

STATION	LOCATION	FREQUENCY
Station A	Norway	12.1 kHz
Station B	Liberia	12.0 kHz
Station C	Hawaii	11.8 kHz
Station D	North Dakota	13.1 kHz
Station E	La Reunion	12.3 kHz
Station F	Argentina	12.9 kHz
Station G	Australia	13.0 kHz
Station H	Japan	12.8 kHz

b. VLF

(1) The U.S. Navy operates a communications system in the VLF band. The stations are located worldwide and transmit at powers of 500-1000 kW. Some airborne OMEGA receivers have the capability to receive and process these VLF signals for navigation in addition to OMEGA signals. The VLF stations generally used for navigation are located in Australia, Japan, England, Hawaii and in the U.S. in Maine, Washington and Maryland.

(2) Although the Navy does not object to the use of VLF communications signals for navigation, the system is not dedicated to navigation. Signal format, transmission,

and other parameters of the VLF system are subject to change at the Navy's discretion. The VLF communications stations are individually shut down for scheduled maintenance for a few hours each week. Regular NOTAM service regarding the VLF system or station status is not available. However, the Naval Observatory provides a taped message concerning phase differences, phase values, and shutdown information for both the VLF communications network and the OMEGA system (phone 202-653-1757).

c. Operational Use of OMEGA and OMEGA/VLF

(1) The OMEGA navigation network is capable of providing consistent fixing information to an accuracy of plus or minus 2 NM depending upon the level of sophistication of the receiver/processing system. OMEGA signals are affected by propagation variables which may degrade fix accuracy. These variables include daily variation of phase velocity, polar cap absorption, and sudden solar activity. Daily compensation for variation within the receiver/processor, or occasional excessive solar activity and its effect on OMEGA, cannot be accurately forecast or anticipated. If an unusual amount of solar activity disturbs the OMEGA signal enlargement paths to any extent, the U.S. Coast Guard advises the FAA and an appropriate NOTAM is sent.

(2) At 16 minutes past each hour, WWV (Fort Collins, Colorado) broadcasts a message concerning the status of each OMEGA station, signal irregularities, and other information concerning OMEGA. At 47 minutes past each hour, WWVH (Hawaii) broadcasts similar information. The U.S. Coast Guard provides a taped OMEGA status report (703-866-3801). NOTAMS concerning OMEGA are available through any FSS. OMEGA NOTAMs should be requested by OMEGA station name.

(3) The FAA has recognized OMEGA and OMEGA/VLF systems as an additional means of en route IFR navigation in the conterminous United States and Alaska when approved in accordance with FAA guidance information. Use of OMEGA or OMEGA/VLF requires that all navigation equipment otherwise required by the Federal Aviation Regulations be installed and operating. When flying RNAV routes, VOR and DME equipment is required.

(4) The FAA recognizes the use of the Naval VLF communications system as a supplement to OMEGA, but not the sole means of navigation.

22. VHF DIRECTION FINDER

a. The VHF Direction Finder (VHF/DF) is one of the common systems that helps pilots without their being aware of its operation. It is a ground based radio receiver used by the operator of the ground station. FAA facilities that provide VHF/DF service are identified in the Airport/Facility Directory.

b. The equipment consists of a directional antenna system and a VHF radio receiver.

c. The VHF/DF receiver display indicates the magnetic direction of the aircraft from the ground station each time the aircraft transmits.

d. DF equipment is of particular value in locating lost aircraft and in helping to identify aircraft on radar. (See PARA. 452 - DIRECTION FINDING INSTRUMENT APPROACH PROCEDURE.)

23. INERTIAL NAVIGATION SYSTEM (INS)

A totally self-contained navigation system, comprised o gyros, accelerometers, and a navigation computer, which provides aircraft position and navigation information in response to signals resulting from inertial effects on system components, and does not require information from external references. INS is aligned with accurate position information prior to departure, and thereafter calculates its position as it progresses to the destination. By programming a series of waypoints, the system will navigate along a predetermined track. New waypoints can be inserted at any time if a revised routing is desired. INS accuracy is very high initially following alignment, and decays with time a the rate of about 1-2 nautical miles per hour. Position update alignment can be accomplished inflight using ground based references, and many INS systems now have sophisticated automatic update using dual DME and o VOR inputs. INS may be approved as the sole means o navigation or may be used in combination with other systems.

24. DOPPLER RADAR

A semiautomatic self-contained dead reckoning navigation system (radar sensor plus computer) which is not continuously dependent on information derived from ground based or external aids. The system employs radar signals to detect and measure ground speed and drift angle, using the aircraft compass system as its directional reference. Doppler is less accurate than INS or OMEGA however, and the use of an external reference is required for periodic updates if acceptable position accuracy is to be achieved o long range flights.

25. FLIGHT MANAGEMENT SYSTEM (FMS)

A computer system that uses a large data base to allow routes to be preprogrammed and fed into the system b means of a data loader. The system is constantly updated with respect to position accuracy by reference to conventional navigation aids. The sophisticated program and i associated data base insures that the most appropriate aids are automatically selected during the information update cycle.

26. GLOBAL POSITIONING SYSTEM (GPS)

A space-base radio positioning, navigation, and time transfer system being developed by Department of Defense When fully deployed, the system is intended to provide highly accurate position and velocity information, and precise time, on a continuous global basis, to an unlimited number of properly equipped users. The system will be unaffected by weather, and will provide a worldwide common grid reference system. The GPS concept is predicated upon accurate and continuous knowledge of the spatial position of each satellite in the system with respect to time and distance from a transmitting satellite to the user. The GPS receiver automatically selects appropriate signals from th satellites in view and translates these into a three-dimensional position, velocity, and time. Predicatable system a curacy for civil users is projected to be 100 meters horizontally. Performance standards and certification criteria have not yet been established.

27—29. RESERVED

pages tightly bound

NOTES

Section 2. RADAR SERVICES AND PROCEDURES

30. RADAR

a. Capabilities

(1) Radar is a method whereby radio waves are transmitted into the air and are then received when they have been reflected by an object in the path of the beam. *Range* is determined by measuring the time it takes (at the speed of light) for the radio wave to go out to the object and then return to the receiving antenna. The *direction* of a detected object from a radar site is determined by the position of the rotating antenna when the reflected portion of the radio wave is received.

(2) More reliable maintenance and improved equipment have reduced radar system failures to a negligible factor. Most facilities actually have some components duplicated-one operating and another which immediately takes over when a malfunction occurs to the primary component.

b. Limitations

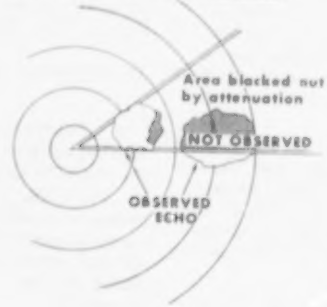
(1) It is very important for the aviation community to recognize the fact that there are limitations to radar service and that ATC controllers may not always be able to issue traffic advisories concerning aircraft which are not under ATC control and cannot be seen on radar.

(a) The characteristics of radio waves are such that they normally travel in a continuous straight line unless they are:

1. "Bent" by abnormal atmospheric phenomena such as temperature inversions;

2. Reflected or attenuated by dense objects such as heavy clouds, precipitation, ground obstacles, mountains, etc.; or

3. Screened by high terrain features.



Precipitation Attenuation

The nearby target absorbs and scatters so much of the out-going and returning energy that the radar does not detect the distant target.

(b) The bending of radar pulses, often called anomalous propagation or ducting, may cause many extraneous blips to appear on the radar operator's display if the beam has been bent toward the ground or may decrease the detection range if the wave is bent upward. It is difficult to solve the effects of anomalous propogation, but using beacon radar and electronically eliminating stationary and slow moving targets by a method called moving target indicator (MTI) usually negate the problem.

(c) Radar energy that strikes dense objects will be reflected and displayed on the operator's scope thereby blocking out aircraft at the same range and greatly weakening or completely eliminating the display of targets at a greater range. Again, radar beacon and MTI are very effectively used to combat ground clutter and weather phenomena, and a method of circularly polarizing the radar beam will eliminate some weather returns. A negative characteristic of MTI is that an aircraft flying a speed that coincides with the canceling signal of the MTI (tangential or "blind" speed) may not be displayed to the radar controller.

(d) Relatively low altitude aircraft will not be seen if they are screened by mountains or are below the radar beam due to earth curvature. The only solution to screening is the installation of strategically placed multiple radars which has been done in some areas.

(e) There are several other factors which affect radar control. The amount of reflective surface of an aircraft will determine the size of the radar return. Therefore, a small light airplane or a sleek jet fighter will be more difficult to see on radar than a large commercial jet or military bomber. Here again, the use of radar beacon is invaluable if the aircraft is equipped with an airborne transponder. All ARTCC radars in the conterminous U.S. and many airport surveillance radars have the capability to interrogate MODE C and display altitude information to the controller from appropriately equipped aircraft. However, there are a number of airport surveillance radars that are still two dimensional (range and azimuth) only and altitude information must be obtained from the pilot.

(f) At some locations within the ATC en route environment, secondary-radar-only (no primary radar) gap filler radar systems are used to give lower altitude radar coverage between two larger radar systems, each of which provides both primary and secondary radar coverage. In those geographical areas served by secondary-radar only, aircraft without transponders cannot be provided with radar service. Additionally, transponder equipped aircraft cannot be provided with radar advisories concerning primary targets and weather. (See RADAR/RADIO DETECTION AND RANGING in the Pilot/Controller Glossary.)

(g) The controllers' ability to advise a pilot flying on instruments or in visual conditions of his proximity to another aircraft will be limited if the unknown aircraft is not observed on radar, if no flight plan information is available, or if the volume of traffic and workload prevent his issuing traffic information. The controller's first priority is given to establishing vertical, lateral, or longitudinal separation between aircraft flying IFR under the control of ATC.

c. FAA radar units operate continuously at the locations shown in the Airport/Facility Directory, and their services are available to all pilots, both civil and military. Contact the associated FAA control tower or ARTCC on any frequency guarded for initial instructions, or in an emergency, any FAA facility for information on the nearest radar service.

31. AIR TRAFFIC CONTROL RADAR BEACON SYSTEM (ATCRBS)

a. The ATCRBS, sometimes referred to as secondary surveillance radar, consists of three main components:

(1) **Interrogator.** Primary radar relies on a signal being transmitted from the radar antenna site and for this signal to be reflected or "bounced back" from an object (such as an aircraft). This reflected signal is then displayed as a "target" on the controller's radarscope. In the ATCRBS, the *Interrogator*, a ground based radar beacon transmitter-receiver, scans in synchronism with the primary radar and transmits discrete radio signals which repetitiously requests all transponders, on the mode being used, to reply. The replies received are then mixed with the primary returns and both are displayed on the same radarscope.

(2) **Transponder.** This airborne radar beacon transmitter-receiver automatically receives the signals from the interrogator and selectively replies with a specific pulse group (code) only to those interrogations being received on the mode to which it is set. These replies are independent of, and much stronger than a primary radar return.

(3) **Radarscope.** The radarscope used by the controller displays returns from both the primary radar system and the ATCRBS. These returns, called targets, are what the controller refers to in the control and separation of traffic.

b. The job of identifying and maintaining identification of primary radar targets is a long and tedious task for the controller. Some of the advantages of ATCRBS over primary radar are:

(1) **Reinforcement of radar targets.**

(2) **Rapid target identification.**

(3) **Unique display of selected codes.**

c. A part of the ATCRBS ground equipment is the decoder. This equipment enables the controller to assign discrete transponder codes to each aircraft under his control. Normally only one code will be assigned for the entire flight. Assignments are made by the ARTCC computer on the basis of the National Beacon Code Allocation Plan. The equipment is also designed to receive MODE C altitude information from the aircraft.

NOTE.— Refer to figures with explanatory legends for an illustration of the target symbology depicted on radar scopes in the NAS Stage A (en route), the ARTS III (terminal) systems, and other nonautomated (broadband) radar systems.

d. It should be emphasized that aircraft transponders greatly improve the effectiveness of radar systems. (See PARA—170 - TRANSPONDER OPERATION.)

32. SURVEILLANCE RADAR

a. Surveillance radars are divided into two general categories: Airport Surveillance Radar (ASR) and Air Route Surveillance Radar (ARSR).

(1) ASR is designed to provide relatively short-range coverage in the general vicinity of an airport and to serve as an expeditious means of handling terminal area traffic through observation of precise aircraft locations on a radarscope. The ASR can also be used as an instrument approach aid.

(2) ARSR is a long-range radar system designed primarily to provide a display of aircraft locations over large areas.

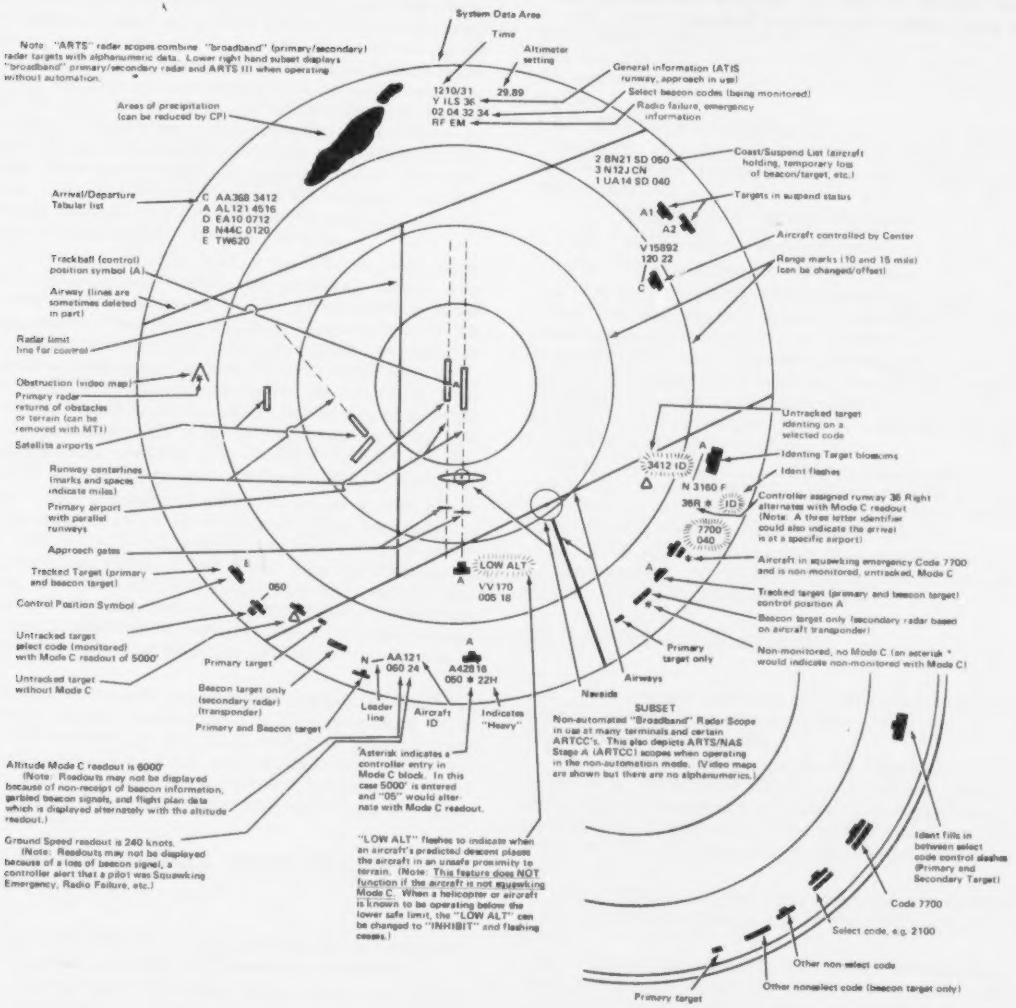
b. Surveillance radars scan through 360 degrees of azimuth and present target information on a radar display located in a tower or center. This information is used independently or in conjunction with other navigational aids in the control of air traffic.

33. PRECISION APPROACH RADAR (PAR)

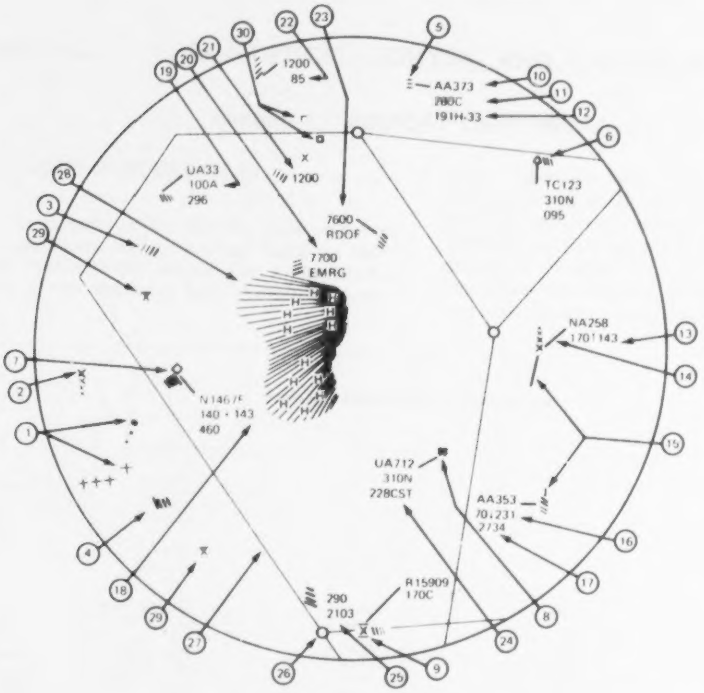
a. PAR is designed to be used as a *landing aid*, rather than an aid for sequencing and spacing aircraft. PAR equipment may be used as a primary landing aid, or it may be used to monitor other types of approaches. It is designed to display *range, azimuth* and *elevation* information.

b. Two antennas are used in the PAR array, one scanning a vertical plane, and the other scanning horizontally. Since the range is limited to 10 miles, azimuth to 20 degrees, and elevation to 7 degrees, only the final approach area is covered. Each scope is divided into two parts. The upper half presents altitude and distance information, and the lower half presents azimuth and distance.

34—39. RESERVED


Note "ARTS" radar scopes combine "broadband" (primary/secondary) radar targets with alphanumeric data. Lower right hand subset displays "broadband" primary/secondary radar and ARTS III when operating without automation.
System Data Area
Time
Altimeter setting
1210/31
29.89
Y ILS 36
02 04 32 34
RF EM
General information (ATIS runway, approach in use)
Select beacon codes (being monitored)
Radio failure, emergency information
Areas of precipitation (can be reduced by CP)
Arrival/Departure Tabular list
C AA368 3412
A AL121 4516
D EA10 0712
B N44C 0120
E TW620
2 BN21 SD 060
3 N12J CN
1 UA14 SD 040
Coast/Suspend List (aircraft holding, temporary loss of beacon/target, etc.)
Targets in suspend status
A1
A2
Aircraft controlled by Center
V 15892
120 22
C
Range marks (10 and 15 mile) (can be changed/offset)
Trackball (control) position symbol (A)
Airway (lines are sometimes deleted in part)
Radar limit line for control
Obstruction (video map)
Primary radar returns of obstacles or terrain (can be removed with MTI)
Satellite airports
Runway centerlines (marks and spaces indicate miles)
Primary airport with parallel runways
Approach gates
Tracked Target (primary and beacon target)
E
Control Position Symbol
060
Untracked target select code (monitored) with Mode C readout of 5000'
Untracked target without Mode C
Primary target
Beacon target only (secondary radar) (transponder)
Primary and Beacon target
A
LOW ALT
VV 170
005 18
N
AA121
060 24
Leader line
Aircraft ID
A
A42816
050 * 22H
Indicates "Heavy"
Untracked target identing on a selected code
3412 ID
A
Identing Target blossoms
Ident flashes
N 3160 F
36R * ID
Controller assigned runway 36 Right alternates with Mode C readout (Note: A three letter identifier could also indicate the arrival is at a specific airport)
7700
040
Aircraft in squawking emergency Code 7700 and is non-monitored, untracked, Mode C
A
Tracked target (primary and beacon target) control position A
Beacon target only (secondary radar based on aircraft transponder)
Non-monitored, no Mode C (an asterisk * would indicate non-monitored with Mode C)
Primary target only
Airways
Navaids
Altitude Mode C readout is 6000' (Note: Readouts may not be displayed because of non-receipt of beacon information, garbled beacon signals, and flight plan data which is displayed alternately with the altitude readout.)
Ground Speed readout is 240 knots. (Note: Readouts may not be displayed because of a loss of beacon signal, a controller alert that a pilot was Squawking Emergency, Radio Failure, etc.)
Asterisk indicates a controller entry in Mode C block. In this case 5000' is entered and "05" would alternate with Mode C readout.
"LOW ALT" flashes to indicate when an aircraft's predicted descent places the aircraft in an unsafe proximity to terrain. (Note: This feature does NOT function if the aircraft is not squawking Mode C. When a helicopter or aircraft is known to be operating below the lower safe limit, the "LOW ALT" can be changed to "INHIBIT" and flashing ceases.)
SUBSET
Non-automated "Broadband" Radar Scope in use at many terminals and certain ARTCC's. This also depicts ARTS/NAS Stage A (ARTCC) scopes when operating in the non-automation mode. (Video maps are shown but there are no alphanumerics.)
Ident fills in between select code control slashes (Primary and Secondary Target)
Code 7700
Select code, e.g. 2100
Other non-select code
Other nonselect code (beacon target only)
Primary target

ARTS III Radar Scope with Alphanumeric Data. Note: A number of radar terminals do not have ARTS equipment. Those facilities and certain ARTCC's outside the contiguous US would have radar displays similar to the lower right hand subset. ARTS facilities and NAS Stage A ARTCC's, when operating in the non-automation mode would also have similar displays and certain services based on automation may not be available.



Target Symbols

1 Uncorrelated primary radar target + ●

2 *Correlated primary radar target X

3 Uncorrelated beacon target /

4 Correlated beacon target \

5 Identing beacon target ▪
(*Correlated means the association of radar data with the computer projected track of an identified aircraft)

Position Symbols

6 Free track (No flight plan tracking) △

7 Flat track (flight plan tracking) ◊

8 Coast (Beacon target lost) #

9 Present Position Hold ⧗

Data Block Information

10 *Aircraft Identification

11 *Assigned Altitude FL280, mode C altitude same or within ±200' of asgnd altitude

12 *Computer ID #191, Handoff is to Sector 33 (0-33 would mean handoff accepted) (*Nr's 10, 11, 12 constitute a "full data block")

13 Assigned altitude 17,000', aircraft is climbing, mode C readout was 14,300 when last beacon interrogation was received

14 Leader line connecting target symbol and data block

15 Track velocity and direction vector line (Projected ahead of target)

16 Assigned altitude 7000, aircraft is descending, last mode C readout (or last reported altitude was 100' above FL230

17 Transponder code shows in full data block only when different than assigned code

18 Aircraft is 300' above assigned altitude

19 Reported altitude (No mode C readout) same as assigned. An "N" would indicate no reported altitude)

20 Transponder set on emergency code 7700 (EMRG flashes to attract attention)

21 Transponder code 1200 (VFR) with no mode C

22 Code 1200 (VFR) with mode C and last altitude readout

23 Transponder set on Radio Failure code 7600, (RDOF flashes)

24 Computer ID #228, CST indicates target is in Coast status

25 Assigned altitude FL290, transponder code (These two items constitute a "limited data block")

Other symbols

26 Navigational Aid

27 Airway or jet route

28 Outline of weather returns based on primary radar (See Chapter 4, ARTCC Radar Weather Display. H's represent areas of high density precipitation which might be thunderstorms. Radial lines indicate lower density precipitation)

29 Obstruction

30 Airports Major: ☐ , Small: ⌜

NAS Stage A Controllers View Plan Display. This figure illustrates the controller's radar scope (PVD) when operating in the full automation (RDP) mode, which is normally 20 hours per day. (Note: When not in automation mode, the display is similar to the broadband mode shown in the ARTS III Radar Scope figure. Certain ARTCC's outside the contiguous U.S. also operate in "broadband" mode.)

NOTES

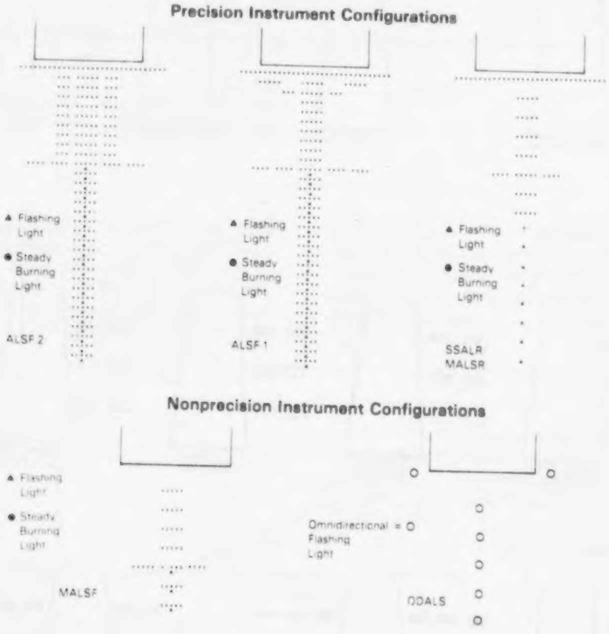
Chapter 2. AERONAUTICAL LIGHTING AND AIRPORT MARKING AIDS

Section 1. AIRPORT LIGHTING AIDS

40. APPROACH LIGHT SYSTEMS (ALS)

a. Approach light systems provide the basic means to transition from instrument flight to visual flight for landing. Operational requirements dictate the sophistication and configuration of the approach light system for a particular runway.

b. Approach light systems are a configuration of signal lights starting at the landing threshold and extending into the approach area a distance of 2400-3000 feet for precision instrument runways and 1400-1500 feet for nonprecision instrument runways. Some systems include sequenced flashing lights which appear to the pilot as a ball of light traveling towards the runway at high speed (twice a second).


Precision Instrument Configurations

Nonprecision Instrument Configurations

41. VISUAL APPROACH SLOPE INDICATOR (VASI)

a. The VASI is a system of lights so arranged to provide visual descent guidance information during the approach to a runway. These lights are visible from 3-5 miles during the day and up to 20 miles or more at night. The visual glide path of the VASI provides safe obstruction clearance within plus or minus 10 degrees of the extended runway centerline and to 4 NM from the runway threshold. Descent, using the VASI, should not be initiated until the aircraft is visually aligned with the runway. Lateral course guidance is provided by the runway or runway lights.

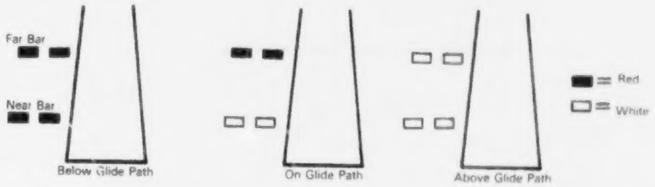
b. VASI installations may consist of either 2, 4, 6, 12, or 16 lights units arranged in bars referred to as near, middle, and far bars. Most VASI installations consist of 2 bars, near and far, and may consist of 2, 4, or 12 light units. Some VASIs consist of three bars, near, middle, and far, which provide an additional visual glide path to accommodate high cockpit aircraft. This installation may consist of either 6 or 16 light units. VASI installations consisting of 2, 4, or 6 light units are located on one side of the runway, usually the left. Where the installation consists of

12 or 16 light units, the units are located on both sides of the runway.

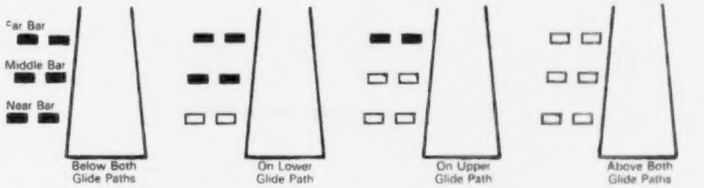
c. Two-bar VASI installations provide one visual glide path which is normally set at 3 degrees. Three-bar VASI installations provide two visual glide paths. The lower glide path is provided by the near and middle bars and is normally set at 3 degrees while the upper glide path, provided by the middle and far bars, is normally 1/4 degree higher. This higher glide path is intended for use only by high cockpit aircraft to provide a sufficient threshold crossing height. Although normal glide path angles are three degrees, angles at some locations may be as high as 4.5 degrees to give proper obstacle clearance. Pilots of high performance aircraft are cautioned that use of VASI angles in excess of 3.5 degrees may cause an increase in runway length required for landing and rollout.

d. The basic principle of the VASI is that of color differentiation between red and white. Each light unit projects a beam of light having a white segment in the upper part of the beam and red segment in the lower part of the beam. The light units are arranged so that the pilot using the VASIs during an approach will see the combination of lights shown below.

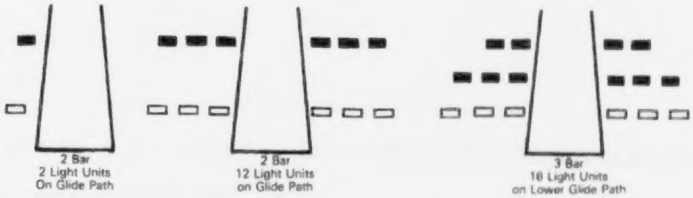
e. 2-bar VASI (4 light units shown)


Far Bar
Near Bar
Below Glide Path
On Glide Path
Above Glide Path
■ = Red
□ = White

f. 3-bar VASI (6 light units shown)


Far Bar
Middle Bar
Near Bar
Below Both Glide Paths
On Lower Glide Path
On Upper Glide Path
Above Both Glide Paths

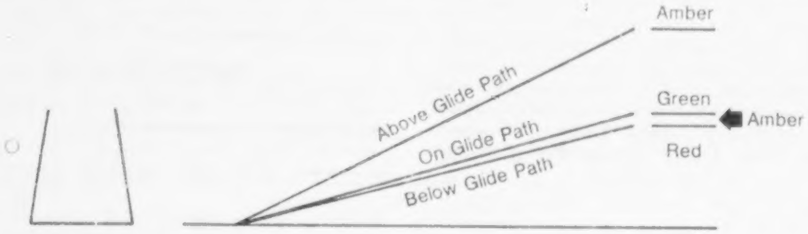
g. Other VASI configurations


2 Bar
2 Light Units
On Glide Path
2 Bar
12 Light Units
on Glide Path
3 Bar
16 Light Units
on Lower Glide Path

42. OTHER VISUAL APPROACH SLOPE SYSTEMS

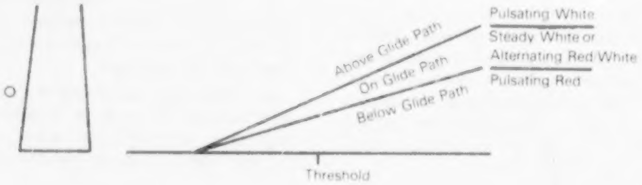
a. Several types of nonstandard visual approach slope indicators have been installed at general aviation and air carrier airports.

b. Tri-color visual approach slope indicators normally consist of a single light unit projecting a three-color visual approach path into the final approach area of the runway upon which the indicator is installed. The below glide path indication is red, the above glide path indication is amber, and the on glide path indication is green. These types of indicators have a useful range of approximately one-half to one mile during the day and up to five miles at night depending upon the visibility conditions.



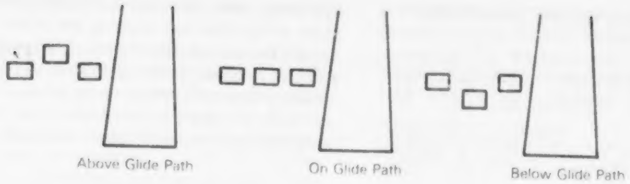
Caution: When the aircraft descends from green to red, the pilot may see a dark amber color during the transition from green to red.

c. Pulsating visual approach slope indicators normally consist of a single light unit projecting a two-color visual approach path into the final approach area of the runway upon which the indicator is installed. The below glide path indication is normally pulsating red and the above glide path indication is normally pulsating white. The on glide path indication for one type of system is a steady white light while for another type system the on glide path indication consists of an alternating red and white light. The useful range of these systems is about four miles during the day and up to ten miles at night.

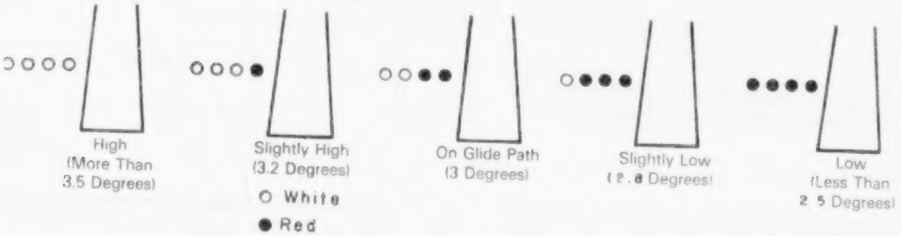


Caution: When viewing the pulsating visual approach slope indicators in the pulsating white or pulsating red sectors, it is possible to mistake this lighting aid for another aircraft or a ground vehicle. Pilots should exercise caution when using this type of system.

d. Alignment of elements systems are installed on some small general aviation airports and are a low-cost system consisting of painted plywood panels, normally black and white or fluorescent orange. Some of these systems are lighted for night use. The useful range of these systems is approximately three-quarter miles. To use the system the pilot positions his aircraft so the elements are in alignment. The glide path indications are as follows.



e. The precision approach path indicator (PAPI) uses light units similar to the VASI but are installed in a single row of either two or four light units. These systems have an effective visual range of about 5 miles during the day and up to 20 miles at night. The row of light units is normally installed on the left side of the runway and the glide path indications are as follows.



43. RUNWAY END IDENTIFIER LIGHTS (REIL)

REILs are installed at many airfields to provide rapid and positive identification of the approach end of a particular runway. The system consists of a pair of synchronized flashing lights located laterally on each side of the runway threshold. REILs may be either omnidirectional or unidirectional facing the approach area. REILs may be located longitudinally 200 feet either upwind or downwind from the runway threshold. They are effective for:

(1) Identification of a runway surrounded by a preponderance of other lighting.

(2) Identification of a runway which lacks contrast with surrounding terrain.

(3) Identification of a runway during reduced visibility.

44. RUNWAY EDGE LIGHT SYSTEMS

a. Runway edge lights are used to outline the edges of runways during periods of darkness or restricted visibility conditions. These light systems are classified according to the intensity or brightness they are capable of producing: they are the High Intensity Runway Lights (HIRL), Medium Intensity Runway Lights (MIRL), and the Low Intensity Runway Lights (LIRL). The HIRL and MIRL systems have variable intensity controls, whereas the LIRLs normally have one intensity setting.

b. The runway edge lights are white, except on instrument runways amber replaces white on the last 2,000 feet or half the runway length, whichever is less, to form a caution zone for landings.

c. The lights marking the ends of the runway emit red light toward the runway to indicate the end of runway to a departing aircraft and emit green outward from the runway end to indicate the threshold to landing aircraft.

45. IN-RUNWAY LIGHTING

a. Touchdown zone lights and runway centerline lights are installed on some precision approach runways to facilitate landing under adverse visibility conditions. Taxiway turnoff lights may be added to expedite movement of aircraft from the runway.

(1) **Touchdown Zone Lighting (TDZL)** — two rows of transverse light bars disposed symmetrically about the runway centerline in the runway touchdown zone. The system starts 100 feet from the landing threshold and extends to 3000 feet from the threshold or the midpoint of the runway, whichever is the lesser.

(2) **Runway Centerline Lighting (RCLS)** — flush centerline lights spaced at 50-foot intervals beginning 75 feet from the landing threshold and extending to within 75 feet of opposite end of the runway.

(3) **Runway Remaining Lighting** — centerline lighting systems in the final 3,000 feet as viewed from the takeoff or approach position. Alternate red and white lights are seen from the 3,000 foot points to the 1,000 foot points, and all red lights are seen for the last 1,000 feet of the runway. From the opposite direction, these lights are seen as white lights.

(4) **Taxiway turnoff lights** — flush lights spaced at 50 foot intervals defining the curved path of aircraft travel from the runway centerline to a point on the taxiway.

46. CONTROL OF LIGHTING SYSTEMS

a. Operation of approach light systems and runway lighting is controlled by the control tower (ATCT). At some locations the FSS may control the lights where there is no control tower in operation.

b. Pilots may request that lights be turned on or off. Runway edge lights, in-pavement lights and approach lights also have intensity controls which may be varied to meet the pilots request. Sequenced flashing lights (SFL) may be turned on and off. Some sequenced flashing light systems also have intensity control.

c. The Medium Intensity Approach Lighting System with Runway Alignment Indicators (MALSR) is installed at many airports. The control is by ATCTs or radio from approaching aircraft when the tower is closed (See PARA—47 - PILOT CONTROL OF AIRPORT LIGHTING.)

47. PILOT CONTROL OF AIRPORT LIGHTING

a. Radio control of lighting is available at selected airports to provide airborne control of lights by keying the aircraft's microphone. Control of lighting systems is often available at locations without specified hours for lighting and where there is no control tower or FSS or when the tower or FSS is closed (locations with a part-time tower or FSS) or specified hours. All lighting systems which are radio controlled at an airport, whether on a single runway or multiple runways, operate on the same radio frequency.

b. With FAA approved systems, various combinations of medium intensity approach lights, runway lights, taxiway lights, VASI and/or REIL may be activated by radio control. On runways with both approach lighting and runway lighting (runway edge lights, taxiway lights, etc.) systems, the approach lighting system takes precedence for air-to-ground radio control over the runway lighting system which is set at a predetermined intensity step, based on expected visibility conditions. Runways without approach lighting may provide radio controlled intensity adjustments of runway edge lights. Other lighting systems, including VASI, REIL, and taxiway lights may be either controlled with the runway edge lights or controlled independently of the runway edge lights.

c. The control system consists of a 3-step control responsive to 7, 5, and/or 3 microphone clicks. This 3-step control will turn on lighting facilities capable of either 3-step, 2-step or 1-step operation. The 3-step and 2-step lighting facilities can be altered in intensity, while the 1-step cannot. All lighting is illuminated for a period of 15 minutes from the most recent time of activation and may not be extinguished prior to end of the 15 minute period (except for 1-step and 2-step REILs which may be turned off when desired by keying the mike 5 or 3 times respectively).

TABLE 1. RUNWAYS WITH APPROACH LIGHTS

Lighting System	No. of Int. Steps	Status During Nonuse Period	Intensity Step Selected Per No. of Mike Clicks		
			3 Clicks	5 Clicks	7 Clicks
Approach Lights (Med. Int.)	2	Off	Low	Low	High
Approach Lights (Med. Int.)	3	Off	Low	Med	High
MIRL	3	Off or Low	¤	¤	¤
HIRL	5	Off or Low	¤	¤	¤
VASI	2	Off	◊	◊	◊

NOTES:

¤ Predetermined intensity step.
◊ Low intensity for night use. High intensity for day use as determined by photocell control.

TABLE 2. RUNWAYS WITHOUT APPROACH LIGHTS

Lighting System	No. of Int. Steps	Status During Nonuse Period	Intensity Step Selected Per No. of Mike Clicks		
			3 Clicks	5 Clicks	7 Clicks
MIRL	3	Off or Low	Low	Med.	High
HIRL	5	Off or Low	Step 1 or 2	Step 3	Step 5
LIRL	1	Off	On	On	On
VASI☆	2	Off	◊	◊	◊
REIL☆	1	Off	Off	On / Off	On
REIL☆	3	Off	Low	Med.	High

NOTES:

◊ Low intensity for night use. High intensity for day use as determined by photocell control.
☆ The control of VASI and/or REIL may be independent of other lighting systems.

d. Suggested use is to always initially key the mike 7 times; this assures that all controlled lights are turned on to the maximum available intensity. If desired, adjustment can then be made, where the capability is provided, to a lower intensity (or the REIL turned off) by keying 5 and/or 3 times. Even though the runway lights are on when arriving over an airport of intended landing, always key mike as directed in order to assure a full 15 minutes lighting duration. Approved lighting systems may be activated by keying the mike (within 5 seconds) as indicated below:

RADIO CONTROL SYSTEM

Key Mike	*Function*
7 times within 5 seconds	Highest intensity available
5 times within 5 seconds	Medium or lower intensity (Lower REIL or REIL-off)
3 times within 5 seconds	Lowest intensity available (Lower REIL or REIL-off)

e. For all public use airports with FAA standard systems the Airport/Facility Directory contains the types of lighting, runway and the frequency that is used to activate the system. Airports with IAPs include data on the approach chart identifying the light system, the runway on which they are installed, and the frequency that is used to activate the system.

EXAMPLE:

ACTIVATE MIRL Rwy 18/36-122.8.

EXAMPLE:

ACTIVATE MALSR, VASI and REIL Rwy 7, HIRL Rwy 7-25, and REIL Rwy 25-122.8.

f. Where the airport is not served by an IAP, it may have either the standard FAA approved control system or an independent type system of different specification installed by the airport sponsor. The Airport/Facility Directory contains descriptions of pilot controlled lighting systems for each airport having other than FAA approved systems, and explains the type lights, method of control, and operating frequency in clear text.

48. AIRPORT (ROTATING) BEACONS

a. The airport beacon has a vertical light distribution to make it most effective from one to 10 degrees above the horizon; however, it can be seen well above and below this peak spread. The beacon may be an omnidirectional capacitor-discharge device, or it may rotate at a constant speed which produces the visual effect of flashes at regular intervals. Flashes may be one or two colors alternately. The total number of flashes are:

(1) 12 to 30 per minute for beacons marking airports, landmarks, and points on Federal airways.

(2) 30 to 60 per minute for beacons marking heliports.

b. The colors and color combinations of beacons are:

(1) White and Green — Lighted land airport

(2) *Green alone — Lighted land airport

(3) White and Yellow — Lighted water airport

(4) *Yellow alone — Lighted water airport

(5) White and Red — Landmark or navigational point (rare installation)

(6) White alone — Unlighted land airport (rare installation)

(7) Green, Yellow, and White — Lighted heliport

NOTE.— *Green alone or amber alone is used only in connection with a white-and-green or white-and-amber beacon display, respectively.

c. Military airport beacons flash alternately white and green, but are differentiated from civil beacons by dual-peaked (two quick) white flashes between the green flashes.

d. In control zones, operation of the airport beacon during the hours of daylight often indicates that the ground visibility is less than 3 miles and/or the ceiling is less than 1,000 feet. ATC clearance in accordance with FAR—91 is required for landing, takeoff and flight in the traffic pattern. Pilots should not rely solely on the operation of the airport beacon to indicate if weather conditions are IFR or VFR. At some locations with operating control towers, ATC personnel turn the beacon on or off when controls are in the tower. At many airports the airport beacon is turned on by a photoelectric cell or time clocks and ATC personnel can not control them. There is no regulatory requirement for daylight operation and it is the pilot's responsibility to comply with proper preflight planning as required by FAR—91.5.

49. RUNWAY DISTANCE REMAINING MARKERS

Runway distance remaining markers are signs located along the sides of a runway to indicate the remaining runway distance in increments of 1,000 feet. The signs may be located on both sides, or only one side. The signs have white numbers on a black background and are lighted for nighttime and low visibility operations. Since runways rarely exist in exact multiples of 1,000 feet, the excess distance is added to the runway ends. Therefore, the last sign on each runway end may be located more, but never less, then 1,000 feet from the runway end. For this reason, the runway distance remaining markers may not exactly coincide with distance remaining information from other lighting systems.

NOTES

Section 2. AIR NAVIGATION AND OBSTRUCTION LIGHTING

50. AERONAUTICAL LIGHT BEACONS

a. An aeronautical light beacon is a visual NAVAID displaying flashes of white and/or colored light to indicate the location of an airport, a heliport, a landmark, a certain point of a Federal airway in mountainous terrain, or an obstruction. The light used may be a rotating beacon or one or more flashing lights. The flashing lights may be supplemented by steady burning lights of lesser intensity.

b. The color or color combination displayed by a particular beacon and/or its auxiliary lights tell whether the beacon is indicating a landing place, landmark, point of the Federal airways, or an obstruction. Coded flashes of the auxiliary lights, if employed, further identify the beacon site.

51. CODE BEACONS AND COURSE LIGHTS

a. CODE BEACONS

(1) The code beacon, which can be seen from all directions, is used to identify airports and landmarks and to mark obstructions. The number of code beacon flashes are:

(a) **Green coded flashes** not exceeding 40 flashes or character elements per minute, or constant flashes 12 to 15 per minute, for identifying land airports.

(b) **Yellow coded flashes** not exceeding 40 flashes or character elements per minute, or constant flashes 12 to 15 per minute, for identifying water airports.

(c) **Red flashes**, constant rate, 12 to 40 flashes per minute for marking hazards.

b. COURSE LIGHTS

(1) The course light, which can be seen clearly from only one direction, is used only with rotating beacons of the Federal Airway System: two course lights, back to back, direct coded flashing beams of light in either direction along the course of airway.

NOTE.— Airway beacons are remnants of the "lighted" airways which antedated the present electronically equipped Federal Airways System. Only a few of these beacons exist today to mark airway segments in remote mountain areas. Flashes in Morse Code identify the beacon site.

52. OBSTRUCTION LIGHTS

a. Obstructions are marked/lighted to warn airmen of its presence during daytime and nighttime conditions. They may be marked/lighted in any of the following combinations:

(1) **Aviation Red Obstruction Lights.** Flashing aviation red beacons and steady burning aviation red lights during nighttime operation. Aviation orange and white paint is used for daytime marking.

(2) **High Intensity White Obstruction Lights.** Flashing high intensity white lights during daytime with reduced intensity for twilight and nighttime operation. When this type system is used, the marking of structures with red obstruction lights and aviation orange and white paint may be omitted.

(3) **Dual Lighting.** A combination of flashing aviation red beacons and steady burning aviation red lights for nighttime operation and flashing high intensity white lights for daytime operation. Aviation orange and white paint may be omitted.

b. High intensity flashing white lights are being used to identify some supporting structures of overhead transmission lines located across rivers, chasms, gorges, etc. These lights flash in a middle, top, lower light sequence at approximately 60 flashes per minute. The top light is normally installed near the top of the supporting structure, while the lower light indicates the approximate lower portion of the wire span. The lights are beamed towards the companion structure and identify the area of the wire span.

c. High intensity, flashing white lights are also employed to identify tall structures, such as chimneys and towers, as obstructions to air navigation. The lights provide a 360 degree coverage about the structure at 40 flashes per minute and consist of from one to seven levels of lights depending upon the height of the structure. Where more than one level is used the vertical banks flash simultaneously.

53—59. RESERVED

NOTES

Section 3. AIRPORT MARKING AIDS

60. AIRPORT MARKING AIDS

a. In the interest of safety, regularity, or efficiency of aircraft operations, the FAA has recommended, for the guidance of the public, the following airport marking.

NOTE.— Refer to ADVISORY CIRCULAR—150/5340-1 Marking of Paved Areas on Airports for detailed airport marking information.

b. **Runway designators** — Runway numbers and letters are determined from the approach direction. The runway number is the whole number nearest one-tenth the magnetic azimuth of the centerline of the runway, measured clockwise from the magnetic north. The letter, or letters, differentiate between left (L), right (R), or center (C) parallel runways, as applicable:

(1) For two parallel runways "L" "R"

(2) For three parallel runways "L" "C" "R"

c. **Visual Runway Marking** — Used for operations under Visual Flight Rules:

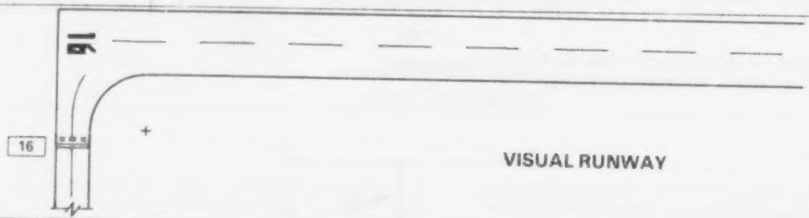
(1) Centerline marking.

(2) Designation marking.

(3) Threshold marking (on runways used or intended to be used by international commercial air transport.)

(4) Fixed distance marking (on runways 4,000 feet (1200 m) or longer used by jet aircraft.)

(5) Holding position markings (for taxiway/runway intersections.)



VISUAL RUNWAY

d. **NonPrecision Instrument Runway Marking** — Used on runways served by a nonvisual navigation aid and intended for landings under instrument weather conditions:

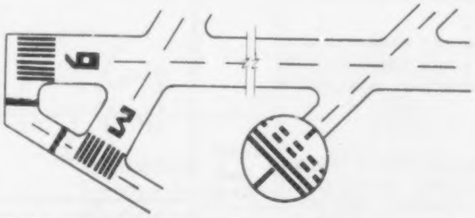
(1) Centerline marking.

(2) Designation marking.

(3) Threshold marking.

(4) Fixed distance marking (on runways 4,000 feet (1200 m) or longer used by jet aircraft.

(5) Holding position markings (for taxiway/runway intersections and instrument landing system (ILS) critical areas.)



NON-PRECISION INSTRUMENT RUNWAY

e. **Precision Instrument Runway Marking** — Used on runways served by nonvisual precision approach aids and on runways having special operational requirements:

(1) Centerline marking.

(2) Designation marking.

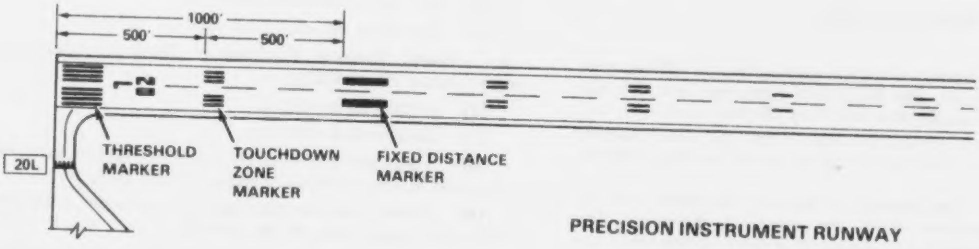
(3) Threshold marking.

(4) Fixed distance marking.

(5) Touchdown zone marking.

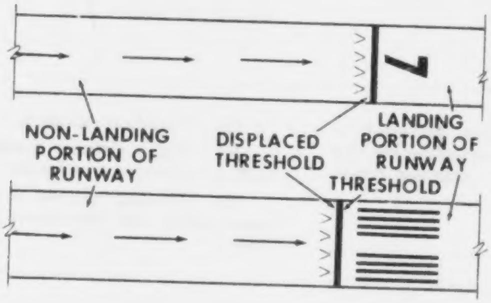
(6) Side stripes.

(7) Holding position markings (for taxiway/runway intersections and ILS critical areas.)

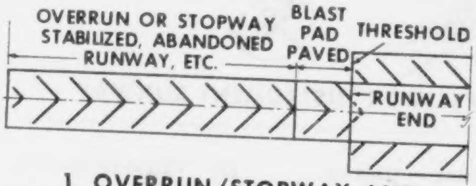

1000'
500'
500'
20L
THRESHOLD MARKER
TOUCHDOWN ZONE MARKER
FIXED DISTANCE MARKER
PRECISION INSTRUMENT RUNWAY

f. Threshold — The designated beginning of the runway that is available and suitable for the landing of aircraft.

g. Displaced Threshold — A threshold that is not at the beginning of the full strength runway pavement. The paved area behind the displaced runway threshold is available for taxiing, the landing rollout, and the takeoff of aircraft.

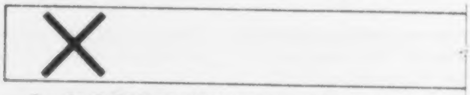

7
NON-LANDING PORTION OF RUNWAY
DISPLACED THRESHOLD
LANDING PORTION OF RUNWAY
THRESHOLD

h. Overrun and Stopway Areas — Any surface or area extending beyond the usable runway which appears usable but which, due to the nature of its structure, is unusable.


OVERRUN OR STOPWAY STABILIZED, ABANDONED RUNWAY, ETC.
BLAST PAD PAVED
THRESHOLD
RUNWAY END

1. OVERRUN/STOPWAY AND BLAST PAD AREA

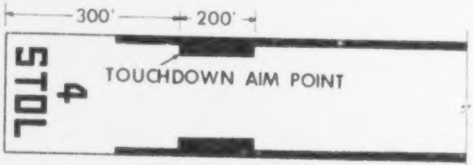
i. Closed Runway — A runway which is unusable and may be hazardous even though it may appear usable.



2. CLOSED RUNWAY OR TAXIWAY

j. **Fixed Distance Marker** — To provide a fixed distance marker for landing of turbojet aircraft on other than a precision instrument runway. This marking is similar to the fixed distance marking on a precision instrument runway and located 1,000 feet from the threshold.

k. **STOL (Short Take Off and Landing) Runway** — In addition to the normal runway number marking, the letters STOL are painted on the approach end of the runway and a touchdown aim point is shown.



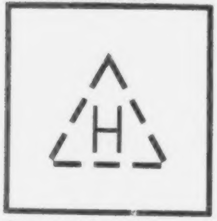
STOL RUNWAY

l. **Taxiway Marking** — The taxiway centerline is marked with a continuous yellow line. The taxiway edge may be marked with two continuous yellow lines 6 inches apart. Taxiway HOLDING LINES consist of two continuous and two dashed lines, spaced 6 inches between lines, perpendicular to the taxiway centerline; more recently, HOLD LINES also consist of one or more signs at the edge of the taxiway, with white characters on a red sign face.

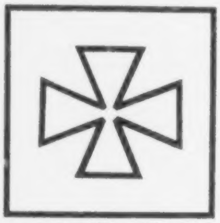
NOTE.— When instructed by ATC "HOLD SHORT OF (runway, ILS critical area, etc.)," the pilot should stop so no part of the aircraft extends beyond the holding line. When approaching the holding line from the side with the continuous lines, a pilot should not cross the holding line without ATC clearance at a controlled airport or without making sure of adequate separation from other aircraft at uncontrolled airports. An aircraft exiting the runway is not clear until all parts of the aircraft have crossed the holding line.

m. **Helicopter Landing Areas** — Details on heliport markings can be found in ADVISORY CIRCULAR—150/5390-1, Heliport Design Guide.

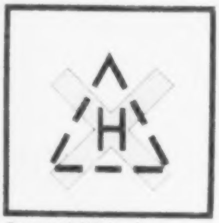
HELICOPTER LANDING AREA



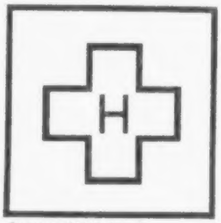
Recommended Marking for Civil Heliports



Some Civil and Military Heliports May Be Marked With This Symbol



Recommended Marking for Closed Heliports



Recommended Marking for Hospital Heliports

61. AIRCRAFT ARRESTING DEVICES

a. Certain airports are equipped with a means of rapidly stopping military aircraft on a runway. This equipment, normally referred to as EMERGENCY ARRESTING GEAR, generally consists of pendant cables supported over the runway surface by rubber "donuts". Although most devices are located in the overrun areas, a few of these arresting systems have cables stretched over the operational areas near the ends of a runway.

b. Arresting cables which cross over a runway require special markings on the runway to identify the cable location. These markings consist of 10 feet diameter solid circles painted "identification yellow", 30 feet on center, perpendicular to the runway centerline across the entire runway width. Additional details are contained in ADVISORY CIRCULAR—150/5220-9, Aircraft Arresting System for Joint/Civil Military Airports.

NOTE.— Aircraft operations on the runway are NOT restricte by the installation of aircraft arresting devices.

62—69. RESERVED

Chapter 3. AIRSPACE

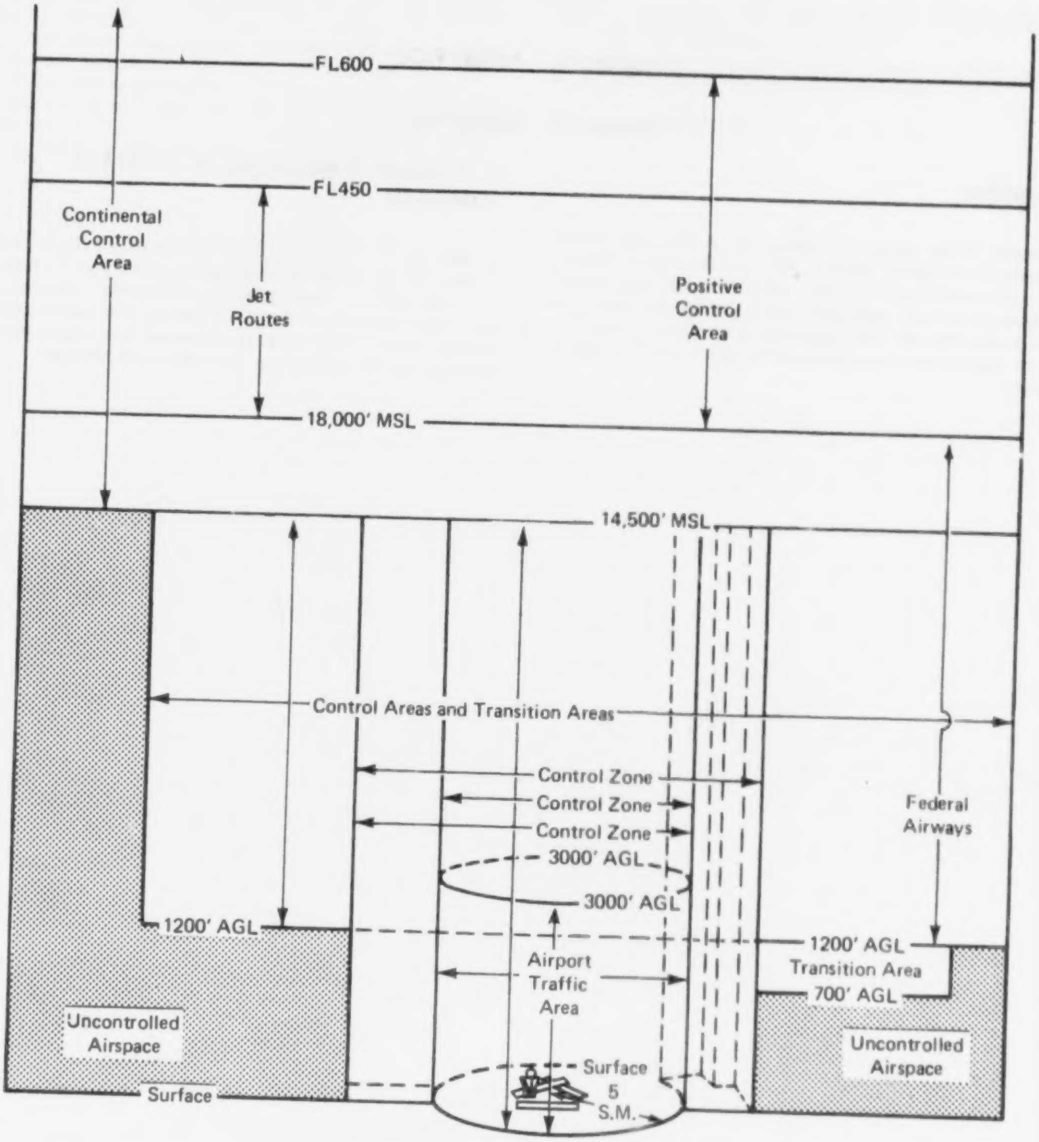
Section 1. GENERAL

70. GENERAL

Because of the nature of some operations, restrictions are required for safety reasons. The complexity or density of aircraft movements in other airspace areas may result in additional aircraft and pilot requirements for operation within such airspace. It is important that pilots be familiar with the operational requirements for the various airspace segments.

71. GENERAL DIMENSIONS OF AIRSPACE SEGMENTS

Refer to Federal Aviation Regulations (FARs) for specific dimensions, exceptions, geographical areas covered, exclusions, specific transponder or equipment requirements, and flight operations. In the following illustration, arrows ending near but not touching reference lines mean up to or down to, but not including, the referenced altitude.


FL600
FL450
Continental Control Area
Jet Routes
Positive Control Area
18,000' MSL
14,500' MSL
Control Areas and Transition Areas
Control Zone
Control Zone
Control Zone
Federal Airways
3000' AGL
3000' AGL
1200' AGL
1200' AGL
Transition Area
700' AGL
Airport Traffic Area
Uncontrolled Airspace
Uncontrolled Airspace
Surface
Surface
5 S.M.

72—79. RESERVED

Section 2. UNCONTROLLED AIRSPACE

80. GENERAL

Uncontrolled airspace is that portion of the airspace that has not been designated as Continental Control Area, Control Area, Control Zone, Terminal Control Area, or Transition Area.

81. VFR REQUIREMENTS

Rules governing VFR flight have been adopted to assist the pilot in meeting his responsibility to see and avoid other aircraft. Minimum weather conditions and distance from clouds required for VFR flight are contained in these rules. (FAR—91.105.)

82. IFR REQUIREMENTS

FARs specify the pilot and aircraft equipment requirements for IFR flight. Pilots are reminded that in addition to altitude or flight level requirements, FAR—91.119 includes a requirement to remain at least 1,000 feet (2,000 feet in designated mountainous terrain) above the highest obstacle within a horizontal distance of 5 statute miles from the course to be flown.

83. MINIMUM VFR VISIBILITY AND DISTANCE FROM CLOUDS

ALTITUDE	UNCONTROLLED AIRSPACE		CONTROLLED AIRSPACE	
	Flight Visibility	Distance From Clouds	**Flight Visibility	**Distance From Clouds
1200′ or less above the surface, regardless of MSL Altitude.	*1 statute mile	Clear of clouds	3 statute miles	500′ below 1000′ above 2000′ horizontal
More than 1200′ above the surface, but less than 10,000′ MSL.	1 statute mile	500′ below 1000′ above 2000′ horizontal	3 statute miles	500′ below 1000′ above 2000′ horizontal
More than 1200′ above the surface and at or above 10,000′ MSL.	5 statute miles	1000′ below 1000′ above 1 statute mile horizontal	5 statute miles	1000′ below 1000′ above 1 statute mile horizontal

*Helicopters may operate with less than 1 mile visibility, outside controlled airspace at 1200 feet or less above the surface, provided they are operated at a speed that allows the pilot adequate opportunity to see any air traffic or obstructions in time to avoid collisions.

**In addition, when operating within a control zone beneath a ceiling, the ceiling must not be less than 1000′. If the pilot intends to land or takeoff or enter a traffic pattern within a control zone, the ground visibility must be at least 3 miles at that airport. If ground visibility is not reported at the airport, 3 miles flight visibility is required. (FAR 91.105)

84. ALTITUDES AND FLIGHT LEVELS

CONTROLLED AND UNCONTROLLED AIRSPACE VFR ALTITUDES AND FLIGHT LEVELS

If your magnetic course (ground track) is	More than 3000′ above the surface but below 18,000′ MSL fly	Above 18,000′ MSL to FL 290 (except within Positive Control Area, FAR 71.193) fly	Above FL 290 (except within Positive Control Area, FAR 71.193) fly 4000′ intervals
0° to 179°	Odd thousands, MSL, plus 500′ (3500, 5500, 7500, etc.).	Odd Flight Levels plus 500′ (FL 195, FL 215, FL 235, etc.).	Beginning at FL 300 (FL 300, 340, 380, etc.)
180° to 359°	Even thousands, MSL, plus 500′ (4500, 6500, 8500, etc.).	Even Flight Levels plus 500′ (FL 185, FL 205, FL 225, etc.).	Beginning at FL 320 (FL 320, 360, 400, etc.)

UNCONTROLLED AIRSPACE - IFR ALTITUDES AND FLIGHT LEVELS

If your magnetic course (ground track) is	Below 18,000′ MSL fly	At or above 18,000′ MSL but below FL 290, fly	At or above FL 290, fly 4000′ intervals
0° to 179°	Odd thousands, MSL, (3000, 5000, 7000, etc.).	Odd Flight Levels, FL 190, 210, 230, etc.).	Beginning at FL 290, (FL 290, 330, 370, etc.)
180° to 359°	Even thousands, MSL, (2000, 4000, 6000, etc.).	Even Flight Levels (FL 180, 200, 220, etc.).	Beginning at FL 310, (FL 310, 350, 390, etc.)

85—89. RESERVED

Section 3. CONTROLLED AIRSPACE

90. GENERAL

Controlled airspace consists of those areas designated as Continental Control Area, Control Area, Control Zones, Terminal Control Areas, Airport Radar Service Area and Transition Areas, within which some or all aircraft may be subject to ATC. Safety, users' needs, and volume of flight operations are some of the factors considered in the designation of controlled airspace. When so designated, the airspace is supported by ground to air communications, navigation aids, and air traffic services.

91. CONTINENTAL CONTROL AREA

a. The Continental Control Area consists of the airspace of the 48 contiguous States, the District of Columbia and Alaska, excluding the Alaska peninsula west of longitude 160 degrees 00 minutes 00 seconds W, at and above 14,500 feet MSL, but does not include:

(1) The airspace less than 1,500 feet above the surface of the earth; or

(2) Prohibited and Restricted areas, other than the Restricted areas listed in FAR—71 Subpart D.

92. CONTROL AREAS

Control Areas consist of the airspace designated as Colored Federal airways, VOR Federal airways, Additional Control Areas, and Control Area Extensions, but do not include the Continental Control Area. Unless otherwise designated, Control Areas also include the airspace between a segment of a main VOR airway and its associated alternate segments. The vertical extent of the various categories of airspace contained in Control Areas is defined in FAR—71.

93. POSITIVE CONTROL AREA

Positive Control Area is airspace so designated as positive control area in FAR—71.193. This area includes specified airspace within the conterminous U.S. from 18,000 feet to and including FL 600, excluding Santa Barbara Island, Farallon Island, and that portion south of latitude 25 degrees 04 minutes north. In Alaska, it includes the airspace over the State of Alaska from 18,000 feet to and including FL 600, but not including the airspace less than 1,500 feet above the surface of the earth and the Alaskan Peninsula west of longitude 160 degrees 00 minutes west. Rules for operating in Positive Control Area are found in FAR—91.97 and FAR—91.24.

94. TRANSITION AREAS

a. Transition Areas are designated to contain IFR operations in controlled airspace during portions of the terminal operation and while transitioning between the terminal and en route environments.

b. Transition Areas are controlled airspace extending upward from 700 feet or more above the surface when designated in conjunction with an airport for which an instrument approach procedure has been prescribed; or from 1,200 feet or more above the surface when designated in conjunction with airway route structures or segments. Unless specified otherwise, Transition Areas terminate at the base of overlying controlled airspace.

95. CONTROL ZONES

a. Control Zones are regulatory in nature and established as controlled airspace. They extend upward from the surface and terminate at the base of the Continental Control Area. Control Zones that do not underlie the Continental Control Area have no upper limit. A Control Zone is based on a primary airport but may include one or more airports and is normally a circular area within a radius of 5 statute miles around the primary airport, except that it may include extensions necessary to include instrument departure and arrival paths.

b. Some basic requirements for designating a control zone are communications and weather observation reporting:

(1) Communications capability with aircraft which normally operate within the control zone must exist down to the runway surface of the primary airport. Communications may be either direct from the ATC facility having jurisdiction over the control zone or by rapid relay through other communications facilities which are acceptable to that ATC facility.

(2) Federally certificated weather observers take hourly and special weather observations at the primary airport in the control zone during the times and dates a control zone is designated. The required weather observations must be forwarded expeditiously to the ATC facility having jurisdiction over the control zones.

c. Control Zones are depicted on charts (for example, on the Sectional Charts the Control Zone is outlined by a broken blue line). If a Control Zone is effective only during certain hours of the day (a part-time Control Zone as prescribed in the regulation) it will be reflected on the charts. A typical Control Zone is depicted in PARA—71. (See PARA—264 - SPECIAL VFR CLEARANCES.)

96. TERMINAL CONTROL AREA

a. A Terminal Control Area (TCA) consists of controlled airspace extending upward from the surface or higher to specified altitudes, within which **all aircraft** are subject to the operating rules and pilot and equipment requirements specified in FAR—91. TCAs are described in FAR—71. Each TCA location is designated as either a Group I or Group II TCA, and includes at least one primary airport around which the TCA is located. (See FAR—71.12.)

(1) Group I TCAs represent some of the busiest locations in terms of aircraft operations and passengers carried. For reasons of safety it is necessary to have strict requirements for operation within Group I TCAs. (See FAR—91.70(c) and FAR—91.90.)

(2) Group II TCAs represent less busy locations, and though safety dictates some pilot and equipment requirements, requirements are not as stringent as those for Group I locations. (See FAR—91.70(c) and FAR—91.90.)

b. TCAs are charted on Sectional, World Aeronautical, En route Low Altitude, DOD FLIP and TCA Charts.

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(1) The following areas are currently designated as Group I TCAs and are depicted on VFR Terminal Area Charts.

Atlanta
Boston
Chicago
Dallas
Los Angeles
Miami
New York
San Francisco
Washington, D.C.

---

(2) The following areas are currently designated as Group II TCAs and are depicted on VFR Terminal Area Charts.

Cleveland
Denver
Detroit
Honolulu
Houston
Kansas City
Las Vegas
Minneapolis
New Orleans
Philadelphia
Pittsburgh
Seattle
St. Louis
San Diego

---

97. TERMINAL CONTROL AREA (TCA) OPERATION

a. Operating Rules and Equipment Requirements. Regardless of weather conditions, ATC authorization is required prior to operating within a TCA. Pilots should not request such authorization unless the requirements of FAR—91.24 and FAR—91.90 are met. Included among these requirements are:

(1) Group I TCAs

(a) A two-way radio capable of communicating with ATC on appropriate frequencies.

(b) A VOR or TACAN receiver, except for helicopters.

(c) A 4096 code transponder with MODE C automatic altitude reporting equipment, except for helicopters operating at or below 1,000 feet AGL under a Letter of Agreement.

NOTE.— ATC may, upon notification, immediately authorize a deviation from the altitude reporting equipment requirement; however, request for a deviation from the 4096 transponder equipment requirement must be submitted to the controlling ATC facility at least 1 hour before the proposed operation.

(d) A private pilot certificate or better in order to land or takeoff from an airport within the TCA.

(e) Unless otherwise authorized by ATC, each person operating a large turbine engine powered airplane to or from a primary airport shall operate at or above the designated floors while within the lateral limits of the TCA.

(f) No person may operate an aircraft in the airspace underlying a TCA, at an indicated airspeed of more than 200 knots (230 mph) (FAR—91.70).

(2) Group II TCAs.

(a) A two-way radio capable of communicating with ATC on appropriate frequencies.

(b) A VOR or TACAN receiver, except for helicopters.

(c) A 4096 code transponder, except for helicopters operating at or below 1,000 feet under a Letter of Agreement, or for IFR flights operating to or from an airport outside of but in close proximity to the TCA when the commonly used transition, approach, or departure procedures to such airport require flight within the TCA.

NOTE.— ATC may authorize deviations from the transponder requirements. Requests for deviation must be submitted to the controlling ATC facility at least 1 hour before the proposed operation.

(d) Unless otherwise authorized by ATC, large turbine powered aircraft must operate at or above the floor of the TCA while operating to or from the primary airport.

(e) No person may operate an aircraft in the airspace underlying a TCA, at an indicated airspeed of more than 200 knots (230 mph) (FAR—91.70).

b. Flight Procedures.

(1) *IFR Flights.* Aircraft within the TCA are required to operate in accordance with current IFR procedures. A clearance for a visual approach to a primary airport is not authorization for turbine powered airplanes to operate below the designated floors of the TCA.

(2) *VFR Flights.*

(a) Arriving flights must contact ATC on the appropriate frequency and in relation to geographical fixes shown on local charts. Although a pilot may be operating beneath the floor of the TCA on initial contact, communications with ATC should be established in relation to the points indicated for spacing and sequencing purposes.

(b) Departing aircraft require a clearance to depart the TCA and should advise the clearance delivery position of their intended altitude and route of flight. ATC will normally advise VFR aircraft when leaving the geographical limits of the TCA. Radar service is not automatically terminated with this advisory unless specifically stated by the controller.

(c) Aircraft not landing or departing the primary airport may obtain ATC clearance to transit the TCA when traffic conditions permit and provided the requirements of FAR—91.90 are met. Such VFR aircraft are encouraged, to the extent possible, to operate at altitudes above or below the TCA or transit through established VFR corridors. Pilots operating in VFR corridors are urged to use frequency 122.750 MHZ for the exchange of aircraft position information.

(d) VFR non-TCA aircraft are cautioned against operating too closely to TCA boundaries, especially where the floor of the TCA is 3,000 feet or less or where VFR cruise altitudes are at or near the floor of higher levels. Observance of this precaution will reduce the potential for encountering a TCA aircraft operating at TCA floor altitudes. Additionally, VFR non-TCA aircraft are encouraged to utilize the VFR Planning Chart as a tool for planning flight in proximity to a TCA. Charted VFR Flyway Planning charts are published on the back of the existing VFR Terminal Area Charts.

c. ATC Clearances and Separation. While operating within a TCA, pilots are provided the service and separation as in Stage III. (See PARA—165 - TERMINAL RADAR PROGRAM FOR VFR AIRCRAFT.) In the event of a radar outage, separation and sequencing of VFR aircraft will be suspended as this service is dependent on radar. The pilot will be advised that the service is not available and issued wind, runway information and the time or place to contact the tower. Traffic information will be provided on a workload permitting basis.

(1) Assignment of radar headings and/or altitudes to aircraft operating in accordance with visual flight rules are based on the provision that a pilot must request an amended clearance if compliance with an assigned route, radar heading or altitude will cause the pilot to violate Basic VFR Weather Minimums.

(2) ATC may assign altitudes to VFR aircraft that do not conform to FAR—91.109. When the altitude assignment is no longer needed for separation or when leaving the TCA, the instruction will be broadcast. "Resume Appropriate VFR Altitudes." Pilots must return to an altitude that conforms to FAR—91.109 as soon as practicable.

98. IFR ALTITUDES AND FLIGHT LEVELS

Pilots operating IFR within controlled airspace will fly at an altitude or flight level assigned by ATC. When operating IFR within controlled airspace with an altitude assignment of **VFR ON TOP**, flight is to be conducted at an appropriate VFR altitude which is not below the minimum IFR altitude for the route. (See PARA—84.) **VFR ON TOP** is not permitted in certain airspace areas, such as positive control airspace, certain Restricted Areas, etc. Consequently, IFR flights operating **VFR ON TOP** will avoid such airspace.

99. RESERVED

100. AIRPORT RADAR SERVICE AREA (ARSA)

a. An Airport Radar Service Area (ARSA) consists of controlled airspace extending upward from the surface or higher to specified altitudes, within which all aircraft are subject to the operating rules and pilot and equipment requirments specified in FAR—91. ARSAs are described in FAR—71. (See FAR—71.14.)

b. Dimensions

(1) *ARSA* (A basic standard design with minor site specific variations.) The ARSA airspace consists of two circles, both centered on the primary/ARSA airport. The inner circle has a radius of 5NM. The outer circle has a radius of 10NM. The airspace of the inner circle extends from the surface of the ARSA airport up to 4,000 feet above that airport. The airspace area between the 5 and 10NM rings begins at a height 1,200 feet AGL and extends to the same altitude cap as the inner circle.

(2) *OUTER AREA* The normal radius will be 20NM, with some variations based on site specific requirements. The outer area extends outward from the primary/ARSA airport and extends from the lower limits of radar/radio coverage up to the ceiling of the approach control's delegated airspace, excluding the ARSA and other airspace as appropriate.

c. ARSAs are charted on Sectional Charts, and some Terminal Control Area Charts.

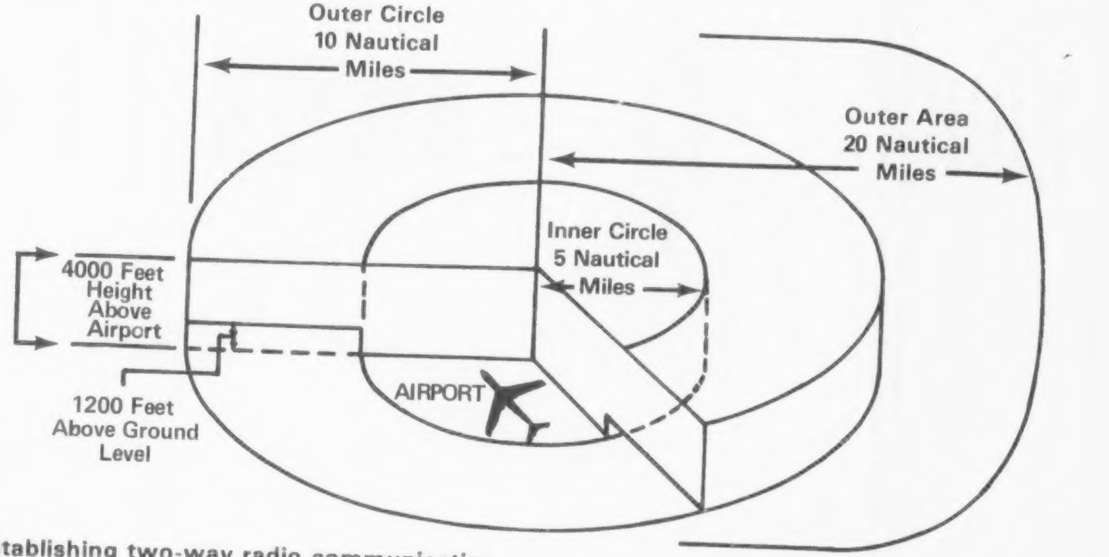
(1) The following areas are currently designated as ARSAs and are depicted on Sectional Charts.

STATE	CITY
ALABAMA	Birmingham
	Mobile
ALASKA	Anchorage
ARIZONA	Davis-Monthan AFB
	Phoenix
	Tuscon
ARKANSAS	Little Rock
CALIFORNIA	Beale AFB
	Burbank
	Castle AFB (Merced)
	El Toro MCAS
	March AFB
	Mather AFB
	McClellan AFB
	Norton
	Ontario
	Sacramento
CONNECTICUT	Windsor Locks (Bradley)
DISTRICT OF COULUMBIA	Washington
FLORIDA	Pensacola
	Whiting NAS
	Pensacola NAS
	Daytona Beach
	Ft. Lauderdale
	Jacksonville
	Orlando
	West Palm Beach
	Tampa
GEORGIA	Columbus
INDIANA	Indianapolis
	South Bend
IOWA	Des Moines
KANSAS	Wichita
KENTUCKY	Louisville
LOUISIANA	Lafayette
MARYLAND	Baltimore
NEBRASKA	Omaha
	Offutt AFB
NEW MEXICO	Albuquerque
NEW YORK	Albany
	Buffalo
	Islip
	Syracuse
NORTH CAROLINA	Charlotte
	Greensboro
	Raleigh/Durham
OKLAHOMA	Tulsa
	Oklahoma City
	Tinker AFB
OHIO	Columbus
	Covington/Cincinnati
	Dayton
OREGON	Portland
RHODE ISLAND	Providence
TENNESSEE	Memphis
	Nashville
TEXAS	Austin
	Corpus Christi
	Dallas
	El Paso
	Lubbock

STATE	CITY
	San Antonio
UTAH	Salt Lake City
VERMONT	Burlington
VIRGINIA	Norfolk
	Richmond
WISCONSIN	Milwaukee

This list will be updated as additional ARSAs are implemented. Pilots should consult current sectional charts and NOTAMs for the latest information on services available. Pilots should be aware that some ARSAs underlie or are adjacent to TCAs.

Airport Radar Service Area (ARSA)


Outer Circle
10 Nautical
Miles
Outer Area
20 Nautical
Miles
Inner Circle
5 Nautical
Miles
4000 Feet
Height
Above
Airport
1200 Feet
Above Ground
Level
AIRPORT

Services upon establishing two-way radio communication and radar contact:

Sequencing Arrivals

IFR/IFR Standard Separation

IFR/VFR Traffic Advisories and Conflict Resolution

VFR/VFR Traffic Advisories

Note: The normal radius of the Outer Area, will be 20nm, with some site specific variations.

IFR: Instrument Flight Rules
VFR: Visual Flight Rules

101. AIRPORT RADAR SERVICE AREA (ARSA) OPERATION

a. **Operating Rules and Pilot/Equipment Requirements**

(1) **Pilot Certification:** Student Pilot or better.

(2) **Equipment:** Two-Way Radio.

(3) **Arrivals and Overflights:** No person may operate an aircraft in an airport radar service area unless two-way radio communication is established with ATC prior to entering that ARSA and is thereafter maintained with ATC, while within that area.

(4) **Departures:**

(a) **Primary Airport:** No person may operate an aircraft within the ARSA unless two-way radio communication is maintained with ATC while within that ARSA.

(b) **Satellite Airports:** Aircraft departing satellite airports/heliports within the ARSA surface area shall establish two-way communication with ATC as soon as possible. Pilots must comply with approved FAA traffic patterns when departing these airports.

(5) **ULTRALIGHT VEHICLES:** No person may operate an ultralight vehicle within an airport radar service area unless that person has prior authorization from the air traffic control facility having jurisdiction over that airspace. (FAR—103)

(6) **Parachute Jumps:** No person may make a parachute jump and no pilot in command may allow a parachute jump to be made from that aircraft in or into an airport radar service area without, or in violation of, the terms of an ATC authorization. (FAR—105)

b. ATC Services

(1) **Within The ARSA:**

(a) Sequencing of all arriving aircraft to the primary/ARSA airport.

(b) Standard IFR separation between IFR aircraft.

(c) Between IFR and VFR aircraft - traffic advisories and conflict resolution so that radar targets do not touch, or 500 feet vertical separation.

(d) Between VFR aircraft - traffic advisories and as appropriate, safety alerts.

(2) **Within The Outer Area:**

(a) The same services are provided for aircraft operating within the outer area, as within the ARSA,*when two-way communication and radar contact is established.*

(b) While pilot participation in this area is strongly encouraged, it is not a VFR requirement.

(3) **Beyond The Outer Area:**

(a) Standard IFR separation.

(b) Basic Radar Service.

(c) Stage II/Stage III Service, where appropriate.

(d) Safety Alert, as appropriate.

c. Since this is a radar program ARSA services will only be provided within radar/radio coverage. In the event of a radar outage, separation and sequencing of VFR aircraft will be suspended. The pilot will be advised that the service is not available and issued wind, runway information and the time to contact the tower.

d. While pilot participation is required within the ARSA, it is voluntary within the outer area and can be discontinued, within the outer area, at the pilots request.

e. ARSA services will be provided in the outer area unless the pilot requests termination of the service.

f. Service provided beyond the outer area will be on a workload permitting basis and can be terminated by the controller if workload dictates.

g. In some locations an ARSA may overlap the airport traffic area of a secondary airport. In order to allow that control tower to provide service to aircraft, portions of the overlapping ARSA may be procedurally excluded when the secondary airport tower is in operation. Aircraft operating in these procedurally excluded areas will only be provided airport traffic control services when in communication with the secondary airport tower. ARSA service to aircraft inbound to these airports will be discontinued when the aircraft is instructed to contact the tower.

h. Aircraft departing secondary controlled airports will not receive ARSA service until they have been radar identified and two-way communication has been established with the ARSA facility.

i. ARSA service to aircraft proceeding to a satellite airport will be terminated at a sufficient distance to allow time to change to the appropriate tower or advisory frequency.

j. Some ARSA facilities shut down for portions of the night. When this occurs, the effective hours of the ARSA will be the same as the operating hours of the serving facility.

102—109. RESERVED

NOTES

Section 4. SPECIAL USE AIRSPACE

110. GENERAL

Special use airspace consists of that airspace wherein activities must be confined because of their nature, or wherein limitations are imposed upon aircraft operations that are not a part of those activities, or both. Except for Controlled Firing Areas, special use airspace areas are depicted on aeronautical charts.

111. PROHIBITED AREA

Prohibited Areas contain airspace of defined dimensions identified by an area on the surface of the earth within which the flight of aircraft is prohibited. Such areas are established for security or other reasons associated with the national welfare. These areas are published in the Federal Register and are depicted on aeronautical charts.

112. RESTRICTED AREA

a. Restricted Areas contain airspace identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Activities within these areas must be confined because of their nature or limitations imposed upon aircraft operations that are not a part of those activities or both. Restricted areas denote the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. Penetration of Restricted Areas without authorization from the using or controlling agency may be extremely hazardous to the aircraft and its occupants. Restricted Areas are published in the Federal Register and constitute FAR—73.

b. ATC facilities apply the following procedures when aircraft are operating on an IFR clearance (including those cleared by ATC to maintain VFR ON TOP) via a route which lies within joint-use restricted airspace.

(1) If the restricted area is not active and has been released to the controlling agency (FAA), the ATC facility will allow the aircraft to operate in the restricted airspace without issuing specific clearance for it to do so.

(2) If the restricted area is active and has not been released to the controlling agency (FAA), the ATC facility will issue a clearance which will ensure the aircraft avoids the restricted airspace unless it is on an approved altitude reservation mission or has obtained its own permission to operate in the airspace and so informs the controlling facility.

NOTE.— The above apply only to joint-use restricted airspace and not to prohibited and nonjoint-use airspace. For the latter categories, the ATC facility will issue a clearance so the aircraft will avoid the restricted airspace unless it is on an approved altitude reservation mission or has obtained its own permission to operate in the airspace and so informs the controlling facility.

c. Restricted airspace is depicted on the En Route Chart appropriate for use at the altitude or flight level being flown. For joint-use restricted areas, the name of the controlling agency is shown on these charts. For all prohibited areas and nonjoint-use restricted areas, unless otherwise requested by the using agency, the phrase "NO A/G" is shown.

113. WARNING AREA

Warning Areas are airspace which may contain hazards to nonparticipating aircraft in international airspace. Warning Areas are established beyond the 3 mile limit. Though the activities conducted within Warning Areas may be as hazardous as those in Restricted Areas, Warning Areas cannot be legally designated as Restricted Areas because they are over international waters. Penetration of Warning Areas during periods of activity may be hazardous to the aircraft and its occupants. Official descriptions of Warning Areas may be obtained on request to the FAA, Washington, D.C.

114. MILITARY OPERATIONS AREAS (MOA)

a. MOAs consist of airspace of defined vertical and lateral limits established for the purpose of separating certain military training activities from IFR traffic. Whenever a MOA is being used, nonparticipating IFR traffic may be cleared through a MOA if IFR separation can be provided by ATC. Otherwise, ATC will reroute or restrict nonparticipating IFR traffic.

b. Most training activities necessitate acrobatic or abrupt flight maneuvers. Military pilots conducting flight in Department of Defense aircraft within a designated and active military operations area (MOA) are exempted from the provisions of FAR 91.71(c) and (d) which prohibit acrobatic flight within Federal airways and control zones.

c. Pilots operating under VFR should exercise extreme caution while flying within a MOA when military activity is being conducted. The activity status (active/inactive) of MOA's may change frequently. Therefore, pilots should contact any FSS within 100 miles of the area to obtain accurate real-time information concerning the MOA hours of operation. Prior to entering an active MOA, pilots should contact the controlling agency for traffic advisories.

d. MOA's are depicted on Sectional, VFR Terminal, Area and Low Altitude En Route Charts.

115. ALERT AREA

Alert Areas are depicted on aeronautical charts to inform nonparticipating pilots of areas that may contain a high volume of pilot training or an unusual type of aerial activity. Pilots should be particularly alert when flying in these areas. All activity within an Alert Area shall be conducted in accordance with FARs, without waiver, and pilots of participating aircraft as well as pilots transiting the area shall be equally responsible for collision avoidance. Information concerning these areas may be obtained upon request to the FAA, Washington, D.C.

116. CONTROLLED FIRING AREAS

Controlled Firing Areas contain activities which, if not conducted in a controlled environment, could be hazardous to nonparticipating aircraft. The distinguishing feature of the Controlled Firing Area, as compared to other special use airspace, is that its activities are suspended immediately when spotter aircraft, radar, or ground lookout positions indicate an aircraft might be approaching the area. There is no need to chart Controlled Firing Areas since they do not cause a nonparticipating aircraft to change its flight path.

117. PARACHUTE JUMP AIRCRAFT OPERATION

a. Procedures relating to parachute jump areas contained in FAR—105. Tabulations of parachute j areas in the U.S. are contained in the Airport/Facility rectory.

b. Pilots of aircraft engaged in parachute jump o ations are reminded that all reported altitudes mus with reference to mean sea level, or flight level, as ap priate, to enable ATC to provide meaningful traffic in mation.

118—129. RESERVED

Section 5. OTHER AIRSPACE AREAS

130. AIRPORT TRAFFIC AREAS

a. Unless otherwise specifically designated (FAR—93), Airport traffic areas consist of the airspace within a horizontal radius of 5 statute miles from the geographical center of any airport at which a control tower is operating, extending from the surface up to, but not including, an altitude of 3,000 feet above the elevation of the airport.

b. The rules prescribed for airport traffic areas are established in FAR—91.70, FAR—91.85, and FAR—91.87. They require, in effect, that unless a pilot is landing or taking off from an airport within the airport traffic area, *the pilot must avoid the area unless specifically authorized by ATC*, either directly from the ATC facility responsible for the airport traffic area, or from the facility from which the pilot is receiving radar services. When authorized by ATC to operate in an airport traffic area, the pilot may expect traffic advisory service on a workload-permitting basis.

c. Unless otherwise authorized, a pilot operating to or from an airport served by a control tower must: (1) establish and maintain radio communications with the tower prior to and while operating in the airport traffic area, (2) Maintain radio communications with the tower while operating on the movement areas of the airport. Maximum indicated airspeeds are prescribed. Airport traffic areas are indicated on VFR Navigation Charts by the blue airport symbol, but the actual boundary is not depicted. (See PARA—71 - GENERAL DIMENSIONS OF AIRSPACE SEGMENTS.)

131. AIRPORT ADVISORY AREA

a. The airport advisory area is the area within 10 statute miles of an airport where a control tower is not operating but where a FSS is located. At such locations, the FSS provides advisory service to arriving and departing aircraft. (See PARA—157 - TRAFFIC AIRPORT ADVISORY PRACTICES AT AIRPORTS WHERE A TOWER IS NOT IN OPERATION.)

b. It is not mandatory that pilots participate in the Airport Advisory Service program, but it is strongly recommended that they do.

132. MILITARY TRAINING ROUTES (MTR)

a. National security depends largely on the deterrent effect of our airborne military forces. To be proficient, the military services must train in a wide range of airborne tactics. One phase of this training involves "low level" combat tactics. The required maneuvers and high speeds are such that they may occasionally make the see-and-avoid aspect of VFR flight more difficult without increased vigilance in areas containing such operations. In an effort to ensure the greatest practical level of safety for all flight operations, the MTR program was conceived.

b. The MTRs program is a joint venture by the FAA and the Department of Defense (DOD). MTR routes are mutually developed for use by the military for the purpose of conducting low-altitude, high-speed training. The routes above 1,500 feet above ground level (AGL) are developed to be flown, to the maximum extent possible, under IFR. The routes at 1,500 feet AGL and below are generally developed to be flown under Visual Flight Rules (VFR).

c. Generally, MTRs are established below 10,000 feet MSL for operations at speeds in excess of 250 knots. However, route segments may be defined at higher altitudes for purposes of route continuity. For example, route segments may be defined for descent, climbout, and mountainous terrain. There are IFR and VFR routes as follows:

(1) IFR Military Training Routes — IR: Operations on these routes are conducted in accordance with IFRs regardless of weather conditions.

(2) VFR Military Training Routes — VR: Operations on these routes are conducted in accordance with VFRs.

d. Military training routes will be identified and charted as follows:

(1) Route identification.

(a) *IR and VR at or below 1,500 feet AGL* (with no segment above 1,500) will be identified by four digit numbers; e.g., IR 1006, VR 1007, etc.

(b) *IR and VR above 1,500 feet AGL* (segments of these routes may be below 1,500) will be identified by three digit numbers; e.g., IR 008, VR 009, etc.

(c) Alternate IR/VR routes or route segments are identified by using the basic/principal route designation followed by a letter suffix, e.g., IR008A, VR1007B, etc.

(2) Route charting.

(a) IFR Low Altitude En Route Chart — This chart will depict all IR routes and all VR routes that accommodate operations above 1,500 feet AGL.

(b) VFR Planning Chart — This chart will depict routes (military training activities such as IR and VR regardless of altitude), MOAs, and restricted, warning and alert areas.

(c) Area Planning (AP/1B) Chart (DOD Flight Information Publication — FLIP). This chart is published by the DOD primarily for military users and contains detailed information on both IR and VR routes. (See PARA—625 - AUXILIARY CHARTS.)

e. The FLIP contains charts and narrative descriptions of these routes. This publication is available to the general public by single copy or annual subscription from the NOAA Distribution Branch, N/CG33 Riverdale, Maryland 20849. This DOD FLIP is available for pilot briefings at FSS and many airports.

f. Nonparticipating aircraft are not prohibited from flying within an MTR; however, extreme vigilance should be exercised when conducting flight through or near these routes. Pilots should contact FSSs within 100 NM of a particular MTR to obtain current information or route usage in their vicinity. Information available includes times of

scheduled activity, altitudes in use on each route segment, and actual route width. Route width varies for each MTR and can extend several miles on either side of the charted MTR centerline. Route width information for IR and VR MTR's is also available in the FLIP AP/1B along with additional MTR (SR/AR) information. When requesting MTR information, pilots should give the FSS their position, route of flight, and destination in order to reduce frequency congestion and permit the FSS specialist to identify the MTR routes which could be a factor.

133. TEMPORARY FLIGHT RESTRICTIONS

a. Temporary flight restrictions may be put into effect in the vicinity of any incident or event which by its nature may generate such a high degree of public interest that the likelihood of a hazardous congestion of air traffic exists. FAR—91.91, as amended, prohibits the operation of nonessential aircraft in airspace that has been designated in a NOTAM as an area within which temporary flight restrictions apply. This rule will be implemented in the case of disasters of substantial magnitude. It will also be implemented as necessary in the case of demonstrations, riots, and other civil disturbances, as well as major sporting events, parades, pageants, and similar functions which are likely to attract large crowds and encouraging viewing from the air. (See PARA—294 — NOTICE TO AIRMEN (NOTAM) SYSTEM.)

b. NOTAM's implementing temporary flight restrictions will contain a description of the area in which the restrictions apply. Normally the area will include the airspace below 2,000 feet above the surface within 5 miles of the site of the incident. However, the exact dimensions will be included in the NOTAM.

c. Pilots are not to operate aircraft within such an area described in the NOTAM unless they are one of the following:

(1) That aircraft is participating in disaster relief tivities and is being operated under the direction of agency responsible for relief activities;

(2) They are operating to or from an airport with the area and such operation will not hamper or endang relief activities;

(3) Their operation is authorized under an IFR A clearance;

(4) Flight around the area is impracticable beca of weather or other considerations and advance notic given to the Air Traffic facility specified in the NOTA and en route flight through the area will not hamper endanger relief activities; or

(5) They are carrying accredited news represe tives or persons on official business concerning the i dent, and the flight is conducted in accordance with FAR 91.79 and a flight plan is filed with the Air Traffic faci specified in the NOTAM.

d. Flight Limitations in the proximity of Space Flig Operations are designated in a Notice to Airm (NOTAM). FAR—91.102 provides protection from potent ly hazardous situations for pilots and space flight cre and costly delays of shuttle operations.

e. Flight Restrictions in the proximity of Presiden and Other Parties are put into effect because numer aircraft and large assemblies of persons may be attrac to areas to be visited or traveled by the President or V President, heads of foreign states, and other public figur Such conditions may create a hazard to aircraft engaged air commerce and to persons and property on the grou In addition, responsible agencies of the United States G ernment may determine that certain regulatory acti should be taken in the interest of providing protection these public figures. FAR—91.104 provides for the issua of a regulatory NOTAM to establish flight restricti where required in such cases.

134—149. RESERVED

Chapter 4. AIR TRAFFIC CONTROL

Section 1. SERVICES AVAILABLE TO PILOTS

150. AIR ROUTE TRAFFIC CONTROL CENTERS

Centers are established primarily to provide Air Traffic Service to aircraft operating on IFR flight plans within controlled airspace, and principally during the en route phase of flight.

151. CONTROL TOWERS

Towers have been established to provide for a safe, orderly and expeditious flow of traffic on and in the vicinity of an airport. When the responsibility has been so delegated, towers also provide for the separation of IFR aircraft in the terminal areas (See PARA—362 - APPROACH CONTROL.)

152. FLIGHT SERVICE STATIONS

FSSs are air traffic facilities which provide pilot briefings, en route communications and VFR search and rescue services, assist lost aircraft and aircraft in emergency situations, relay ATC clearances, originate Notices to Airmen, broadcast aviation weather and NAS information, receive and process IFR flight plans, and monitor NAVAIDS. In addition, at selected locations FSSs provide En Route Flight Advisory Service (Flight Watch), take weather observations, issue airport advisories, and advise Customs and Immigration of transborder flights.

153. RECORDING AND MONITORING

a. Calls to air traffic control (ATC) facilities (ARTCCs, Towers, FSSs, Central Flow, and Operations Centers) over radio and ATC operational telephone lines (lines used for operational purposes such as controller instructions, briefings, opening and closing flight plans, issuance of IFR clearances and amendments, counter hijacking activities, etc.) may be monitored and recorded for operational uses such as accident investigations, accident prevention, search and rescue purposes, specialist training and evaluation, and technical evaluation and repair of control and communications systems.

b. Where the public access telephone is recorded, a beeper tone is not required. In place of the "beep" tone the FCC has substituted a mandatory requirement that persons to be recorded be given notice they are to be recorded and give consent. Notice is given by this entry, consent to record is assumsed by the individual placing a call to the operational facility.

154. COMMUNICATIONS RELEASE OF IFR AIRCRAFT LANDING AT AN AIRPORT NOT BEING SERVED BY AN OPERATING TOWER

Aircraft operating on an IFR flight plan, landing at an airport not being served by a tower will be advised to change to the airport advisory frequency when direct communications with ATC is no longer required. Towers and centers do not have nontower airport traffic and runway in use information. The instrument approach may not be aligned with the runway in use; therefore, if the information has not already been obtained, pilots should make an expeditious change to the airport advisory frequency when authorized. (See PARA—363-ADVANCE INFORMATION ON INSTRUMENT APPROACH.)

155. PILOT VISITS TO AIR TRAFFIC FACILITIES

Pilots are encouraged to visit air traffic facilities (Towers, Centers and FSSs) and participate in "Operation Raincheck". Operation Raincheck is a program designed to familiarize pilots with the ATC system, its functions, responsibilities and benefits. On rare occasions, facilities may not be able to approve a visit because of ATC workload or other reasons. It is therefore requested that pilots contact the facility prior to the visit and advise of the number of persons in the group, the time and date of the proposed visit and the primary interest of the group. With this information available, the facility can prepare an itinerary and have someone available to guide the group through the facility.

156. APPROACH CONTROL SERVICE FOR VFR ARRIVING AIRCRAFT

a. Numerous approach control facilities have established programs for arriving VFR aircraft to contact approach control for landing information. This information includes: wind, runway, and altimeter setting at the airport of intended landing. This information may be omitted if contained in the ATIS broadcast and the pilot states the appropriate ATIS code.

NOTE.— Pilot use of "have numbers" does not indicate receipt of the ATIS broadcast. In addition, the controller will provide traffic advisories on a workload permitting basis.

b. Such information will be furnished upon initial contact with concerned approach control facility. The pilot will be requested to change to the *tower* frequency at a predetermined time or point, to receive further landing information.

c. Where available, use of this procedure will not hinder the operation of VFR flights by requiring excessive spacing between aircraft or devious routing.

d. Compliance with this procedure is not mandatory but pilot participation is encouraged. (See PARA—165-TERMINAL RADAR PROGRAMS FOR VFR AIRCRAFT.)

157. TRAFFIC ADVISORY PRACTICES AT AIRPORTS WITHOUT OPERATING CONTROL TOWERS

a. Airport Operations Without Operating Control Tower

(1) There is no substitute for alertness while in the vicinity of an airport. It is essential that pilots be alert and look for other traffic and exchange traffic information when approaching or departing an airport without an operating control tower. This is of particular importance since other aircraft may not have communication capability or, in some cases, pilots may not communicate their presence or intentions when operating into or out of such airports. To achieve the greatest degree of safety, it is essential that all radio-equipped aircraft transmit/receive on a common frequency identified for the purpose of airport advisories.

(2) An airport may have a full or part-time tower or flight service station (FSS) located on the airport, a full or part-time UNICOM station or no aeronautical station at all. There are three ways for pilots to communicate their intention and obtain airport/traffic information when operating at an airport that does not have an operating tower: by communicating with an FSS, a UNICOM operator, or by making a self-announce broadcast.

b. Communicating on a Common Frequency.

(1) The key to communicating at an airport without an operating control tower is selection of the correct common frequency. The acronym*CTAF* which stands for Common Traffic Advisory Frequency, is synonymous with this program. A CTAF is a frequency designated for the purpose of carrying out airport advisory practices while operating to or from an airport without an operating control tower. The CTAF may be a UNICOM, MULTICOM, FSS, or tower frequency and is identified in appropriate aeronautical publications.

(2) The CTAF frequency for a particular airport is contained in the Airport/Facility Directory (A/FD), Alaska Supplement, Alaska Terminal Publication, Instrument Approach Procedure Charts, and Standard Instrument Departure (SID) charts. Also, the CTAF frequency can be obtained by contacting any FSS. Use of the appropriate CTAF, combined with a visual alertness and application of the following recommended good operating practices, will enhance safety of flight into and out of all uncontrolled airports.

c. Recommended Traffic Advisory Practices.

All inbound traffic should monitor and communicate as appropriate on the designated CTAF from 10 miles to landing. Departing aircraft should monitor/communicate on the appropriate frequency from start-up, during taxi, and until 10 miles from the airport unless the FARs or local procedures require otherwise.

d. Airport Advisory Service Provided by an FSS.

(1) Airport Advisory Service (AAS) is a service provided by an FSS physically located on an airport which does not have a control tower or where the tower is operated on a part-time basis. The CTAF for FSSs which provide this service will be disseminated in appropriate aeronau cal publications.

(2) In communicating with a CTAF FSS, establi two-way communications before transmitting outbound/i bound intentions or information. An inbound aircra should report approximately 10 miles from the airport, r porting altitude and aircraft type, location relative to th airport, state whether landing or overflight, and reque airport advisory. Departing aircraft should state the a craft type, full identification number, type of flig planned, i.e., VFR or IFR and the planned destination direction of flight. Report before taxiing and before taxiin on the runway for departure. If communications with UNICOM are necessary after initial report to FSS, retur to FSS frequency for traffic update.

(a) Inbound

EXAMPLE:

> VERO BEACH RADIO, CENTURION SIX NINE DELTA DELTA IS TEN MILES SOUTH, TWO THO SAND, LANDING VERO BEACH. REQUEST AI PORT ADVISORY.

(b) Outbound

EXAMPLE:

> VERO BEACH RADIO, CENTURION SIX NINE DELTA DELTA, READY TO TAXI, VFR, DEPAR ING TO THE SOUTHWEST. REQUEST AIRPOR ADVISORY.

(3) A CTAF FSS provides wind direction and velo ty, favored or designated runway, altimeter setting, know traffic, notices to airmen, airport taxi routes, airport traffi pattern information, and instrument approach procedure These elements are varied so as to best serve the curre traffic situation. Some airport managers have specifi that under certain wind or other conditions designat runways be used. Pilots should advise the FSS of th runway they intend to use.

CAUTION: All aircraft in the vicinity of an airpo may not be in communication with the FSS.

e. Information Provided by Aeronautical Advisory Stations (UNICOM).

(1) UNICOM is a nongovernment air/ground radi communication station which may provide airport informa tion at public use airports where there is no tower or FS

(2) On pilot request, UNICOM stations may provid pilots with weather information, wind direction, the recom mended runway, or other necessary information. If th UNICOM frequency is designated as the CTAF, it will b identified in appropriate aeronautical publications.

(3) Should AAS by an FSS or, Aeronautical Advisor Station (UNICOM) be unavailable, wind and weather info mation may be obtainable from nearby controlled airport via Automatic Terminal Information Service (ATIS) o Automated Weather Observing System (AWOS) frequenc

f. Self-Announce Position and/or Intentions.

(1) **General.** *Self-announce* is a procedure whereb pilots broadcast their position or intended flight activity o ground operation on the designated CTAF. This procedur is used primarily at airports which do not have an FSS o the airport. The self-announce procedure should also b used if a pilot is unable to communicate with the FSS o the designated CTAF.

(2) If an airport has a tower and it is temporarily closed, or operated on a part-time basis and there is no FSS on the airport or the FSS is closed, use the CTAF to self-announce your position or intentions.

(3) Where there is no tower, FSS, or UNICOM station on the airport, use MULTICOM frequency 122.9 for self-announce procedures. Such airports will be identified in appropriate aeronautical information publications.

(4) **Practice Approaches.** Pilots conducting practice instrument approaches should be particularly alert for other aircraft that may be departing in the opposite direction. When conducting any practice approach, regardless of its direction relative to other airport operations, pilots should make announcements on the CTAF as follows:

(a) departing the final approach fix, inbound (non precision approach) or departing the outer marker or fix used in lieu of the outer marker, inbound (precision approach);

(b) established on the final approach segment or immediately upon being released by ATC;

(c) upon completion or termination of the approach; and

(d) upon executing the missed approach procedure.

(5) Departing aircraft should always be alert for arrival aircraft coming from the opposite direction.

(6) **Recommended Self—Announce Phraseologies:** It should be noted that aircraft operating to or from another nearby airport may be making self-announce broadcasts on the same UNICOM or MULTICOM frequency. To help identify one airport from another, the airport name should be spoken at the beginning and end of each self-announce transmission.

(a) Inbound

EXAMPLE:

STRAWN TRAFFIC, APACHE TWO TWO FIVE ZULU, (POSITION), (ALTITUDE), (DESCENDING) OR ENTERING DOWNWIND/BASE/FINAL (AS APPROPRIATE) RUNWAY ONE SEVEN FULL STOP, TOUCH-AND-GO, STRAWN.

STRAWN TRAFFIC APACHE TWO TWO FIVE ZULU LEAVING RUNWAY ONE SEVEN STRAWN.

(b) Outbound

EXAMPLE:

STRAWN TRAFFIC, QUEEN AIR SEVEN ONE FIVE FIVE BRAVO (LOCATION ON AIRPORT) TAXIING TO RUNWAY TWO SIX STRAWN.

STRAWN TRAFFIC, QUEEN AIR SEVEN ONE FIVE FIVE BRAVO DEPARTING RUNWAY TWO SIX. "DEPARTING THE PATTERN TO THE (DIRECTION), CLIMBING TO (ALTITUDE) STRAWN."

(c) Practice Instrument Approach

EXAMPLE:

STRAWN TRAFFIC, CESSNA TWO ONE FOUR THREE QUEBEC (NAME - FINAL APPROACH FIX) INBOUND DESCENDING THROUGH (ALTITUDE) PRACTICE (TYPE) APPROACH RUNWAY THREE FIVE STRAWN.

STRAWN TRAFFIC, CESSNA TWO ONE FOUR THREE QUEBEC PRACTICE (TYPE) APPROACH COMPLETED OR TERMINATED RUNWAY THREE FIVE STRAWN.

g. UNICOM Communications Procedures.

(1) In communicating with a UNICOM station, the following practices will help reduce frequency congestion, facilitate a better understanding of pilot intentions, help identify the location of aircraft in the traffic pattern, and enhance safety of flight:

(a) Select the correct UNICOM frequency.

(b) State the identification of the UNICOM station you are calling in each transmission.

(c) Speak slowly and distinctly.

(d) Report approximately 10 miles from the airport, reporting altitude, and state your aircraft type, aircraft idenification, location relative to the airport, state whether landing or overflight, and request wind information and runway in use.

(e) Report on downwind, base, and final approach.

(f) Report leaving the runway.

(2) Recommended UNICOM Phraseologies:

(a) Inbound

EXAMPLE:

FREDERICK UNICOM CESSNA EIGHT ZERO ONE TANGO FOXTROT 10 MILES SOUTHEAST DESCENDING THROUGH (ALTITUDE) LANDING FREDERICK, REQUEST WIND AND RUNWAY INFORMATION FREDERICK.

FREDERICK TRAFFIC CESSNA EIGHT ZERO ONE TANGO FOXTROT ENTERING DOWNWIND/BASE/FINAL (AS APPROPRIATE) FOR RUNWAY ONE NINE FULL STOP, TOUCH-AND-GO FREDERICK.

FREDERICK TRAFFIC CESSNA EIGHT ZERO ONE TANGO FOXTROT LEAVING RUNWAY ONE NINE FREDERICK.

(b) Outbound

EXAMPLE:

FREDERICK UNICOM CESSNA EIGHT ZERO ONE TANGO FOXTROT (LOCATION ON AIRPORT) TAXIING TO RUNWAY ONE NINE, REQUEST WIND AND TRAFFIC INFORMATION FREDERICK.

FREDERICK TRAFFIC CESSNA EIGHT ZERO ONE TANGO FOXTROT DEPARTING RUNWAY ONE NINE. "REMAINING IN THE PATTERN" OR "DEPARTING THE PATTERN TO THE (DIRECTION) (AS APPROPRIATE)" FREDERICK.

SUMMARY OF RECOMMENDED COMMUNICATION PROCEDURES

	FACILITY AT AIRPORT	FREQUENCY USE	COMMUNICATION/BROADCAST PROCEDUR		
			OUTBOUND	*INBOUND*	*PRACTIC INSTRUMEN APPROAC*
1.	UNICOM (No Tower or FSS)	Communicate with UNICOM station on published CTAF frequency (122.7, 122.8, 122.725, 122.975, or 123.0). If unable to contact UNICOM station, use self-announce procedures on CTAF.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	
2.	No Tower, FSS, or UNICOM	Self-announce on MULTICOM frequency 122.9.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	Departing fi approach fi (name) or o final appro segment inbound. Approach completed/ terminated
3.	No Tower in operation, FSS open	Communicate with FSS on CTAF frequency.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	
4.	FSS closed (No Tower)	Self-announce on CTAF.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	
5.	Tower or FSS not in operation	Self-announce on CTAF.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	

158. IFR APPROACHES/GROUND VEHICLE OPERATIONS

a. IFR Approaches.

When operating in accordance with an IFR clearance and ATC approves a change to the advisory frequency, make an expeditious change to the CTAF and employ the recommended traffic advisory procedures.

b. Ground Vehicle Operation.

Airport ground vehicles equipped with radios should monitor the CTAF frequency when operating on the airport movement area and remain clear of runways/taxiways being used by aircraft. Radio transmissions from ground vehicles should be confined to safety-related matters.

c. Radio Control of Airport Lighting Systems.

Whenever possible, the CTAF will be used to control airport lighting systems at airports without operating control towers. This eliminates the need for pilots to change frequencies to turn the lights on and allows a continuous listening watch on a single frequency. The CTAF is published on the instrument approach chart and in other appropriate aeronautical information publications. For further details concerning radio controlled lights, see AC 15 5340.27.

159. DESIGNATED UNICOM/MULTICOM FREQUENCIES

a. Communications Between Aircraft.

CAUTION—The Federal Communications Comm sion (FCC) requires an aircraft station license to operate UNICOM/MULTICOM frequencies and usage must be accordance with Part 87 of the FCC Rules (See Sectio 87.29 regarding license applications). Misuse of these fr quencies may result in either the imposition of fines an or revocation/suspension of FCC aircraft station license.

b. Frequency Use.

The following listing depicts UNICOM and MULT

COM frequency uses as designated by the Federal Communications Commission (FCC).

FREQUENCY	USE
122.700	Airports without an operating control tower
122.725	Airports without an operating control tower
122.800	Airports without an operating control tower
123.000	Airports without an operating control tower
122.975	Airports without an operating control tower
122.900	(MULTICOM frequency) Airports with no tower, FSS, or UNICOM
122.950	Airports with a control tower
122.725	Private airports (not open to public)
122.975	High altitude
123.050	Heliports
123.075	Heliports

NOTE— In some areas of the country, frequency interference may be encountered from nearby airports using the same UNICOM frequency. Where this is a problem, UNICOM operators are encouraged to develop a *least interference* frequency assignment plan for airports concerned using the five frequencies designated for airports without operating control towers. UNICOM licensees may then request FCC to assign frequencies in accordance with the plan, which they will review and consider for approval.

160. USE OF UNICOM FOR ATC PURPOSES

UNICOM service may be used for air traffic control purposes, only under the following circumstances:

(1) Revision to proposed departure time.

(2) Takeoff, arrival, or flight plan cancellation time.

(3) ATC clearance, provided arrangements are made between the ATC facility and the UNICOM licensee to handle such messages.

161. AUTOMATIC TERMINAL INFORMATION SERVICE (ATIS)

a. ATIS is the continuous broadcast of recorded noncontrol information in selected high activity terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information. Pilots are urged to cooperate in the ATIS program as it relieves frequency congestion on approach control, ground control, and local control frequencies. The Airport Facility/Directory indicates airports for which ATIS is provided.

b. ATIS information includes the time of the latest weather sequence, ceiling, visibility (if the weather is above a ceiling/sky condition of 5,000 feet and the visibility is 5 miles or more, inclusion of the ceiling/sky condition, visibility, and obstructions to vision in the ATIS message is optional), obstructions to visibility, temperature, dew point (if available), wind direction (magnetic) and velocity, altimeter, other pertinent remarks, instrument approach and runways in use is continuously broadcast on the voice feature of a TVOR/VOR/VORTAC located on or near the airport, or in a discrete VHF/UHF frequency. The departure runway will only be given if different from the landing runway except at locations having a separate ATIS for departure. Where VFR arrival aircraft are expected to make initial contact with approach control, this fact and the appropriate frequencies may be broadcast on ATIS. Pilots of aircraft arriving or departing the terminal area can receive the continuous ATIS broadcasts at times when cockpit duties are least pressing and listen to as many repeats as desired. ATIS broadcasts shall be updated upon the receipt of any official weather, regardless of content change and reported values. A new recording will also be made when there is a change in other pertinent data such as runway change, instrument approach in use, etc.

EXAMPLE:

DULLES INTERNATIONAL INFORMATION SIERRA. 1300ZULU WEATHER. MEASURED CEILING THREE THOUSAND OVERCAST. VISIBILITY THREE, SMOKE. TEMPERATURE SIX EIGHT. WIND THREE FIVE ZERO AT EIGHT. ALTIMETER TWO NINER NINER TWO. ILS RUNWAY ONE RIGHT APPROACH IN USE. LANDING RUNWAY ONE RIGHT AND LEFT. DEPARTURE RUNWAY THREE ZERO. ARMEL VORTAC OUT OF SERVICE. ADVISE YOU HAVE SIERRA.

c. Pilots should listen to ATIS broadcasts whenever ATIS is in operation.

d. Pilots should notify controllers on initial contact that they have received the ATIS broadcast by repeating the alphabetical code word appended to the broadcast.

EXAMPLE:

"INFORMATION SIERRA RECEIVED."

e. When the pilot acknowledges that he has received the ATIS broadcast, controllers may omit those items contained in the broadcast if they are current. Rapidly changing conditions will be issued by ATC and the ATIS will contain words as follows:

EXAMPLE:

"LATEST CEILING/VISIBILITY/ALTIMETER/WIND/(other conditions) WILL BE ISSUED BY APPROACH CONTROL/TOWER."

NOTE.— The absence of a sky condition or ceiling and/or visibility on ATIS indicates a sky condition or ceiling of 5,000 feet or above and visibility of 5 miles or more. A remark may be made on the broadcast, "The weather is better than 5000 and 5," or the existing weather may be broadcast.

f. Controllers will issue pertinent information to pilots who do not acknowledge receipt of a broadcast or who acknowledge receipt of a broadcast which is not current.

g. To serve frequency limited aircraft, FSSs are equipped to transmit on the omnirange frequency at most en route VORs used as ATIS voice outlets. Such communication interrupts the ATIS broadcast. Pilots of aircraft equipped to receive on other FSS frequencies are encouraged to do so in order that these override transmissions may be kept to an absolute minimum.

h. While it is a good operating practice for pilots to make use of the ATIS broadcast where it is available, some pilots use the phrase "Have Numbers" in communications with the control tower. Use of this phrase means that the pilot has received wind, runway, and altimeter information ONLY and the tower does not have to repeat this informa-

tion. It does not indicate receipt of the ATIS broadcast and should never be used for this purpose.

162. RADAR TRAFFIC INFORMATION SERVICE

This is a service provided by radar ATC facilities. Pilots receiving this service are advised of any radar target observed on the radar display which may be in such proximity to the position of their aircraft or its intended route of flight that it warrants their attention. This service is not intended to relieve the pilot of his responsibility for continual vigilance to see and avoid other aircraft.

a. Purpose of the Service:

(1) The issuance of traffic information as observed on a radar display is based on the principle of assisting and advising a pilot that a particular radar target's position and track indicates it may intersect or pass in such proximity to his intended flight path that it warrants his attention. This is to alert the pilot to the traffic so that he can be on the lookout for it and thereby be in a better position to take appropriate action should the need arise.

(2) Pilots are reminded that the surveillance radar used by ATC does not provide altitude information unless the aircraft is equipped with MODE C and the Radar Facility is capable of displaying altitude information

b. Provisions of the Service:

(1) Many factors, such as limitations of the radar, volume of traffic, controller workload and communications frequency congestion, could prevent the controller from providing this service. The controller possesses complete discretion for determining whether he is able to provide or continue to provide this service in a specific case. His reason against providing or continuing to provide the service in a particular case is not subject to question nor need it be communicated to the pilot. In other words, the provision of this service is entirely dependent upon whether the controller believes he is in a position to provide it. Traffic information is routinely provided to all aircraft operating on IFR Flight Plans except when the pilot advises he does not desire the service, or the pilot is operating within positive controlled airspace. Traffic information may be provided to flights not operating on IFR Flight Plans when requested by pilots of such flights.

NOTE.— Radar ATC facilities normally display and monitor both primary and secondary radar when it is available, except that secondary radar may be used as the sole display source in Positive Control Airspace (PCA), and under some circumstances outside of PCA (beyond primary coverage and in en route areas where only secondary is available). Secondary radar may also be used outside PCA as the sole display source when the primary radar is temporarily unusable or out of service. Pilots in contact with the affected ATC facility are normally advised when a temporary outage occurs; i.e., "primary radar out of service; traffic advisories available on transponder aircraft only." This means simply that only the aircraft which have transponders installed and in use will be depicted on ATC radar indicators when the primary radar is temporarily out of service.

(2) When receiving VFR radar advisory service, pilots should monitor the assigned frequency at all times. This is to preclude controllers' concern for radio failure or emergency assistance to aircraft under his jurisdiction. VFR radar advisory service does not include vectors away from conflicting traffic unless requested by the pilot. When advisory service is no longer desired, advise the controller before changing frequencies and then change your tra ponder code to 1200, if applicable. Pilots should also info the controller when changing VFR cruising altitu Except in programs where radar service is automatica terminated, the controller will advise the aircraft wh radar is terminated.

NOTE.— Participation by VFR pilots in formal programs im mented at certain terminal locations constitutes pilot request. T also applies to participating pilots at those locations where ar ing VFR flights are encouraged to make their first contact w the tower on the approach control frequency.

c. Issuance of Traffic Information — Traffic inform tion will include the following concerning a target wh may constitute traffic for an aircraft that is:

(1) Radar identified:

(a) Azimuth from the aircraft in terms of the hour clock, or

(b) When rapidly maneuvering civil test or m tary aircraft prevent accurate issuance of traffic as in above, specify the direction from an aircraft's position terms of the eight cardinal compass poi (N,NE,E,SE,S,SW,W,NW). This method shall be termina at the pilot's request.

(c) Distance from the aircraft in nautical miles;

(d) Direction in which the target is proceedi and

(e) Type of aircraft and altitude if known.

EXAMPLE:

Traffic 10 o'clock, 3 miles, west-bound (type aircr and altitude, if known, of the observed traffic). The titude may be known, by means of MODE C, but verified with the pilot for accuracy. (To be valid separation purposes by ATC, the accuracy of MODE readouts must be verified. This is usually accomplish upon initial entry into the radar system by a compa son of the readout to pilot stated altitude, or the fi elevation in the case of continuous readout being ceived from an aircraft on the airport.) When nec sary to issue traffic advisories containing unverified titude information, the controller will issue the advis ry in the same manner as if it were verified due to t accuracy of these readouts. The pilot may upon rec of traffic information, request a vector (heading) avoid such traffic. The vector will be provided to t extent possible as determined by the controller prov ed the aircraft to be vectored is within the airsp under the jurisdiction of the controller.

(2) Not radar identified:

(a) Distance and direction with respect to a fix;

(b) Direction in which the target is proceedi and

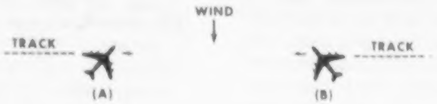
(c) Type of aircraft and altitude if known.

EXAMPLE:

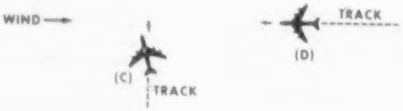
Traffic 8 miles south of the airport northeastbou (type aircraft and altitude if known).

d. The examples depicted in the following figures po out the possible error in the position of this traffic whe is necessary for a pilot to apply drift correction to maint this track. This error could also occur in the event change in course is made at the time radar traffic inform tion is issued.

(1) In this figure traffic information would be issued to the pilot of aircraft "A" as 12 o'clock. The actual position of the traffic as seen by the pilot of aircraft "A" would be 2 o'clock. Traffic information issued to aircraft "B" would also be given as 12 o'clock, but in this case, the pilot of "B" would see his traffic at 10 o'clock.



(2) In this figure traffic information would be issued to the pilot of aircraft "C" as 2 o'clock. The actual position of the traffic as seen by the pilot of aircraft "C" would be 3 o'clock. Traffic information issued to aircraft "D" would be at an 11 o'clock position. Since it is not necessary for the pilot of aircraft "D" to apply wind correction (crab) to make good his track, the actual position of the traffic issued would be correct. Since the radar controller can only observe aircraft track (course) on his radar display, he must issue traffic advisories accordingly, and pilots should give due consideration to this fact when looking for reported traffic.



163. SAFETY ALERT

A safety alert will be issued to pilots of aircraft being controlled by ATC if the controller is aware the aircraft is at an altitude which, in the controller's judgment, places the aircraft in unsafe proximity to terrain, obstructions or other aircraft. The provision of this service is contingent upon the capability of the controller to have an awareness of a situation involving unsafe proximity to terrain, obstructions and uncontrolled aircraft. The issuance of a safety alert cannot be mandated, but it can be expected on a reasonable, though intermittent basis. Once the alert is issued, it is solely the pilot's prerogative to determine what course of action, if any, he will take. This procedure is intended for use in time critical situations where aircraft safety is in question. Noncritical situations should be handled via the normal traffic alert procedures.

a. Terrain or Obstruction Alert:

(1) The controller will immediately issue an alert to the pilot of an aircraft under his control when he recognizes that the aircraft is at an altitude which, in his judgment, may be in unsafe proximity to terrain/obstructions. The primary method of detecting unsafe proximity is through MODE C automatic altitude reports.

EXAMPLE:

LOW ALTITUDE ALERT, CHECK YOUR ALTITUDE IMMEDIATELY. THE, as appropriate, MEA/MVA/MOCA IN YOUR AREA IS (altitude) or, if past the final approach fix (non precision approach) or the outer marker or fix used in lieu of the outer marker (precision approach), THE, as appropriate, MDA/DH (if known) is (altitude).

(2) Terminal ARTS IIA, III, AND IIIA facilities have an automated function which, if operating, alerts the controller when a tracked MODE C equipped aircraft under his control is below or is predicted to be below a predetermined minimum safe altitude. This function, called Minimum Safe Altitude Warning (MSAW), is designed solely as a controller aid in detecting potentially unsafe aircraft proximity to terrain/ obstructions. The ARTS IIA, III, and IIIA facility will, when MSAW is operating, provide MSAW monitoring for all aircraft with an operating MODE C altitude encoding transponder that are tracked by the system and are:

(a) Operating on an IFR flight plan, or

(b) Operating VFR and have requested MSAW monitoring.

(3) Terminal AN/TPX-42A (number beacon decoder system) facilities have an automated function called Low Altitude Alert System (LAAS). Although not as sophisticated as MSAW, LAAS alerts the controller when a MODE C transponder equipped aircraft operating on an IFR flight plan is below a predetermined minimum safe altitude.

NOTE.— Pilots operating VFR may request MSAW or LAAS monitoring if their aircraft are equipped with MODE C transponders.

EXAMPLE:

APACHE THREE THREE PAPA REQUEST MSAW/LAAS.

b. Aircraft Conflict Alert:

(1) The controller will immediately issue an alert to the pilot of an aircraft under his control if he is aware of another aircraft which is not under his control is at an altitude which, in the controller's judgment, places both aircraft in unsafe proximity to each other. With the alert, when feasible, the controller will offer the pilot the position of the traffic if time permits and an alternate course(s) of action. Any alternate course(s) of action the controller may recommend to the pilot will be predicated only on other traffic under his control.

EXAMPLE:

AMERICAN THREE, TRAFFIC ALERT, (position of traffic, if time permits), ADVISE YOU TURN RIGHT/LEFT HEADING (degrees) AND/OR CLIMB/DESCEND TO (altitude) IMMEDIATELY.

164. RADAR ASSISTANCE TO VFR AIRCRAFT

a. Radar equipped FAA ATC facilities provide radar assistance and navigation service (vectors) to VFR aircraft provided the aircraft can communicate with the facility, are within radar coverage, and can be radar identified.

b. Pilots should clearly understand that authorization to proceed in accordance with such radar navigational assistance does not constitute authorization for the pilot to violate FARs. In effect, assistance provided is on the basis that navigational guidance information issued is advisory in nature and the job of flying the aircraft safely, remains with the pilot.

c. In many cases, the controller will be unable to determine if flight into instrument conditions will result from his instructions. To avoid possible hazards resulting from being vectored into IFR conditions, pilots should keep the controller advised of the weather conditions in which he is operating and along the course ahead.

d. Radar navigation assistance (vectors) may be initiated by the controller when one of the following conditions exist:

(1) The controller suggests the vector and the pilot concurs.

(2) A special program has been established and vectoring service has been advertised.

(3) In the controller's judgment the vector is necessary for air safety.

e. Radar navigation assistance (vectors) and other radar derived information may be provided in response to pilot requests. Many factors, such as limitations of radar, volume of traffic, communications frequency, congestion, and controller workload could prevent the controller from providing it. The controller has complete discretion for determining if he is able to provide the service in a particular case. His decision not to provide the service in a particular case is not subject to question.

165. TERMINAL RADAR PROGRAMS FOR VFR AIRCRAFT

a. Basic Radar Service

(1) In addition to the use of radar for the control of IFR aircraft, all commissioned radar facilities provide traffic advisories and limited vectoring (on a workload permitting basis) to VFR aircraft.

NOTE.— When the STAGE services were developed, two basic radar services (traffic advisories and limited vectoring) were identified as STAGE I. This definition became, over the years, unnecessary. Therefore, the term STAGE I has been eliminated from use in the field and the handbooks. These basic services will still be provided by all commissioned terminal radar facilities whether they are STAGE II, III, or neither.

(2) Vectoring service may be provided when requested by the pilot or with pilot concurrence when suggested by ATC.

(3) Pilots of arriving aircraft should contact approach control on the publicized frequency and give their position, altitude, radar beacon code (if transponder equipped), destination, and request traffic information.

(4) Approach control will issue wind and runway, except when the pilot states "HAVE NUMBERS" or this information is contained in the ATIS broadcast and the pilot indicates he has received the ATIS information. Traffic information is provided on a workload permitting basis. Approach control will specify the time or place at which the pilot is to contact the tower on local control frequency for further landing information. Upon being told to contact the tower, radar service is automatically terminated.

b. Stage II Service (Radar Advisory and Sequencing for VFR Aircraft)

(1) This service has been implemented at certain terminal locations (See locations listed in the Airport/Facility Directory). The purpose of the service is to adjust the flow of arriving VFR and IFR aircraft into the traffic pattern in a safe and orderly manner and to provide radar traffic information to departing VFR aircraft. Pilot participation is urged but it is not mandatory.

(2) Pilots of arriving VFR aircraft should initiate radio contact on the publicized frequency with approach control when approximately 25 miles from the airport at which Stage II services are being provided. On initial contact by VFR aircraft, approach control will assume that Stage II service is requested. Approach control will provide the pilot with wind and runway (except when the pilot states "HAVE NUMBERS" or that he has received the ATIS information), routings, etc., as necessary for proper sequencing with other participating VFR and IFR traffic en route to the airport. Traffic information will be provided on a workload permitting basis. If an arriving aircraft does not want the service, the pilot should state "NEGATIVE STAGE II" or make a similar comment, on initial contact with approach control.

(3) After radar contact is established, the pilot may navigate on his own into the traffic pattern or, depending on traffic conditions, may be directed to fly specific headings to position the flight behind a preceding aircraft in the approach sequence. When a flight is positioned behind the preceding aircraft and the pilot reports having that aircraft in sight, he will be directed to follow it. If other "nonparticipating" or "local" aircraft are in the traffic pattern, the tower will issue a landing sequence. Radar service will be continued to the runway.

(4) Standard radar separation will be provided between IFR aircraft until such time as the aircraft is sequenced and the pilot sees the traffic he is to follow. Standard radar separation between VFR or between VFR and IFR aircraft will not be provided.

(5) Pilots of departing VFR aircraft are encouraged to request radar traffic information by notifying ground control on initial contact with their request and proposed direction of flight.

EXAMPLE:

XRAY GROUND CONTROL, NOVEMBER ONE EIGHT SIX, READY TO TAXI, VFR SOUTHBOUND, HAVE INFORMATION BRAVO AND REQUEST RADAR TRAFFIC INFORMATION.

NOTE.— Following takeoff, the tower will advise when to contact departure control.

(6) Pilots of aircraft transiting the area and in radar contact/communication with approach control will receive traffic information on a controller workload permitting basis. Pilots of such aircraft should give their position, altitude, radar beacon code (if transponder equipped), destination, and/or route of flight.

c. Stage III Service (Radar Sequencing and Separation Service for VFR Aircraft).

(1) This service has been implemented at certain terminal locations. The service is advertised in the Airport/Facility Directory. The purpose of this service is to provide separation between all participating VFR aircraft and all IFR aircraft operating within the airspace defined as the Terminal Radar Service Area (TRSA). Pilot participation is urged but it is not mandatory.

(2) If any aircraft does not want the service, the pilot should state "NEGATIVE STAGE III" or make a similar comment, on initial contact with approach control or ground control, as appropriate.

(3) TRSAs are depicted on sectional aeronautical charts and listed in the airport/facility directory.

(4) While operating within a TRSA, pilots are provided Stage III service and separation as prescribed in this paragraph. In the event of a radar outage, separation and sequencing of VFR aircraft will be suspended as this service is dependent on radar. The pilot will be advised that the service is not available and issued wind, runway information, and the time or place to contact the tower. Traffic information will be provided on a workload permitting basis.

(5) Visual separation is used when prevailing conditions permit and it will be applied as follows:

(a) When a VFR flight is positioned behind the preceding aircraft and the pilot reports having that aircraft in sight, he will be directed to follow it. Radar service will be continued to the runway.

(b) When IFR flights are being sequenced with other traffic and the pilot reports the aircraft he is to follow in sight, the pilot may be directed to follow it and will be cleared for a "visual approach."

(c) If other "nonparticipating" or "local" aircraft are in the traffic pattern, the tower will issue a landing sequence.

(d) Departing VFR aircraft may be asked if they can visually follow a preceding departure out of the TRSA. If the pilot concurs, he will be directed to follow it until leaving the TRSA.

(6) Until visual separation is obtained, standard vertical or radar separation will be provided.

(a) 1000 feet vertical separation may be used between IFR aircraft.

(b) 500 feet vertical separation may be used between VFR aircraft, or between a VFR and an IFR aircraft.

(c) Radar separation varies depending on size of aircraft and aircraft distance from the radar antenna. The minimum separation used will be 1 1/2 miles for most VFR aircraft under 12,500 pounds GWT. If being separated from larger aircraft, the minimum is increased appropriately.

(7) Pilots operating VFR under Stage III in a TRSA—

(a) Must maintain an altitude when assigned by ATC unless the altitude assignment is to maintain at or below a specified altitude. ATC may assign altitudes for separation that do not conform to FAR—91.109. When the altitude assignment is no longer needed for separation or when leaving the TRSA, the instruction will be broadcast, "RESUME APPROPRIATE VFR ALTITUDES." Pilots must then return to an altitude that conforms to FAR—91.109 as soon as practicable.

(b) When not assigned an altitude, the pilot should coordinate with ATC prior to any altitude change.

(8) Within the TRSA, traffic information on observed but unidentified targets will, to the extent possible, be provided all IFR and participating VFR aircraft. At the request of the pilot, he will be vectored to avoid the observed traffic, insofar as possible, provided the aircraft to be vectored is within the airspace under the jurisdiction of the controller.

(9) Departing aircraft should inform ATC of their intended destination and/or route of flight and proposed cruising altitude.

(10) ATC will normally advise participating VFR aircraft when leaving the geographical limits of the TRSA. Radar service is not automatically terminated with this advisory unless specifically stated by the controller.

d. PILOT RESPONSIBILITY: THESE PROGRAMS ARE NOT TO BE INTERPRETED AS RELIEVING PILOTS OF THEIR RESPONSIBILITIES TO SEE AND AVOID OTHER TRAFFIC OPERATING IN BASIC VFR WEATHER CONDITIONS, TO ADJUST THEIR OPERATIONS AND FLIGHT PATH AS NECESSARY TO PRECLUDE SERIOUS WAKE ENCOUNTERS, TO MAINTAIN APPROPRIATE TERRAIN AND OBSTRUCTION CLEARANCE, OR TO REMAIN IN WEATHER CONDITIONS EQUAL TO OR BETTER THAN THE MINIMUMS REQUIRED BY FAR—91.105. WHENEVER COMPLIANCE WITH AN ASSIGNED ROUTE, HEADING AND/OR ALTITUDE IS LIKELY TO COMPROMISE PILOT RESPONSIBILITY RESPECTING TERRAIN AND OBSTRUCTION CLEARANCE, VORTEX EXPOSURE, AND WEATHER MINIMUMS, APPROACH CONTROL SHOULD BE SO ADVISED AND A REVISED CLEARANCE OR INSTRUCTION OBTAINED.

166. RESERVED.

167. TOWER EN ROUTE CONTROL (TEC)

a. TEC is an ATC program to provide a service to aircraft proceeding to and from metropolitan areas. It links designated approach control areas by a network of identified routes made up of the existing airway structure of the National Airspace System. The FAA initiated an expanded TEC program to include as many facilities as possible. The program's intent is to provide an overflow resource in the low altitude system which would enhance ATC services. A few facilities have historically allowed turbojets to proceed between certain city pairs, such as Milwaukee and Chicago, via tower en route and these locations may continue this service. However, the expanded TEC program will be applied, generally, for nonturbojet aircraft operating at and below 10,000 feet. The program is entirely within the approach control airspace of multiple terminal facilities. Essentially, it is for relatively short flights. Participating pilots are encouraged to use TEC for flights of two hours duration or less. If longer flights are planned, extensive coordination may be required within the multiple complex which could result in unanticipated delays.

b. Pilots requesting TEC are subject to the same delay factor at the destination airport as other aircraft in the ATC system. In addition, departure and en route delays may occur depending upon individual facility workload. When a major metropolitan airport is incurring significant delays, pilots in the TEC program may want to consider an alternative airport experiencing no delay.

c. There are no unique requirements upon pilots to use the TEC program. Normal flight plan filing procedures will ensure proper flight plan processing. Pilots should include the acronym "TEC" in the remarks section of the flight plan when requesting tower en route.

d. All approach controls in the system may not operate up to the maximum TEC altitude of 10,000 feet. IFR flight may be planned to any satellite airport in proximity to the major primary airport via the same routing.

168—169. RESERVED

170. TRANSPONDER OPERATION

a. GENERAL

(1) Pilots should be aware that proper application of transponder operating procedures will provide both VFR and IFR aircraft with a higher degree of safety in the environment where high-speed closure rates are possible. Transponders substantially increase the capability of radar to see an aircraft and the MODE C feature enables the controller to quickly determine where potential traffic conflicts may exist. Even VFR pilots who are not in contact with ATC will be afforded greater protection from IFR aircraft and VFR aircraft which are receiving traffic advisories. Nevertheless, pilots should never relax their visual scanning vigilance for other aircraft.

(2) Air Traffic Control Radar Beacon System (ATCRBS) is similar to and compatible with military coded radar beacon equipment. Civil MODE A is identical to military MODE 3.

(3) Civil and military transponders should be adjusted to the "on" or normal operating position as late as practicable prior to takeoff and to "off" or "standby" as soon as practicable after completing landing roll unless the change to "standby" has been accomplished previously at the request of ATC. IN ALL CASES, WHETHER VFR OR IFR THE TRANSPONDER SHOULD BE OPERATING WHILE AIRBORNE UNLESS OTHERWISE REQUESTED BY ATC.

(4) If a pilot on an IFR flight cancels his IFR flight plan prior to reaching his destination, he should adjust his transponder according to VFR operations.

(5) If entering a U.S. domestic control area from outside the U.S., the pilot should advise on first radio contact with a U.S. radar ATC facility that such equipment is available by adding "transponder" to the aircraft identification.

(6) It should be noted by all users of the ATC Transponders that the coverage they can expect is limited to "line of sight." Low altitude or aircraft antenna shielding by the aircraft itself may result in reduced range. Range can be improved by climbing to a higher altitude. It may be possible to minimize antenna shielding by locating the antenna where dead spots are only noticed during abnormal flight attitudes.

b. TRANSPONDER CODE DESIGNATION

(1) For ATC to utilize one or a combination of the 4096 discrete codes FOUR DIGIT CODE DESIGNATION will be used, e.g., code 2100 will be expressed as TWO ONE ZERO ZERO. Due to the operational characteristics of the rapidly expanding automated air traffic control system, THE LAST TWO DIGITS OF THE SELECTED TRANSPONDER CODE SHOULD ALWAYS READ "00" UNLESS SPECIFICALLY REQUESTED BY ATC TO BE OTHERWISE.

c. AUTOMATIC ALTITUDE REPORTING (MODE C)

(1) Some transponders are equipped with a MODE C automatic altitude reporting capability. This system converts aircraft altitude in 100 foot increments to coded digital information which is transmitted together with MODE C framing pulses to the interrogating radar facility. The manner in which transponder panels are designed differs, therefore, a pilot should be thoroughly familiar with the operation of his transponder so that ATC may realize its full capabilities.

(2) Adjust transponder to reply on the MODE A/3 code specified by ATC and, if equipped, to reply on MODE C with altitude reporting *capability activated* unless deactivation is directed by ATC or unless the installed aircraft equipment has not been tested and calibrated as required by FAR—91.36. If deactivation is required by ATC, turn off the altitude reporting feature of your transponder. An instruction by ATC to "STOP ALTITUDE SQUAWK, ALTITUDE DIFFERS (number of feet) FEET," may be an indication that your transponder is transmitting incorrect altitude information or that you have an incorrect altimeter setting. While an incorrect altimeter setting has no effect on the MODE C altitude information transmitted by your transponder (transponders are preset at 29.92), it would cause you to fly at an actual altitude different from your assigned altitude. When a controller indicates that an altitude readout is invalid, the pilot should initiate a check to verify that the aircraft altimeter is set correctly.

(3) Pilots of aircraft with operating MODE C altitude reporting transponders should report exact altitude or flight level to the nearest hundred foot increment when establishing initial contact with an ATC facility. Exact altitude or flight level reports on initial contact provide ATC with information that is required prior to using MODE C altitude information for separation purposes. This will significantly reduce altitude verification requests.

d. TRANSPONDER IDENT FEATURE

(1) The transponder shall be operated only as specified by ATC. Activate the "IDENT" feature only upon request of the ATC controller.

e. CODE CHANGES

(1) When making routine code changes, pilots should avoid inadvertent selection of codes 7500, 7600 or 7700 thereby causing momentary false alarms at automated ground facilities. For example when switching from code 2700 to code 7200, switch first to 2200 then to 7200, NOT to 7700 and then 7200. This procedure applies to nondiscrete code 7500 and all discrete codes in the 7600 and 7700 series (i.e. 7600-7677, 7700-7777) which will trigger special indicators in automated facilities. Only nondiscrete code 7500 will be decoded as the hijack code.

(2) Under no circumstances should a pilot of a civil aircraft operate the transponder on Code7777. This code is reserved for military interceptor operations.

(3) Military pilots operating VFR or IFR within restricted/warning areas should adjust their transponders to code 4000 unless another code has been assigned by ATC.

f. DEVIATIONS FROM TRANSPONDER REQUIREMENTS

(1) Specific details concerning requirements, exceptions and ATC authorized deviations for transponder and MODE C operation above 12,500 feet and below 18,000 feet MSL are found in FAR—91.24 In general, the FAR requires aircraft to be equipped with MODE A/3 (4096 codes) and MODE C altitude reporting capability when operating in controlled airspace of the 48 contiguous States and the District of Columbia above 12,500 feet MSL, excluding airspace at and below 2,500 feet AGL. Pilots should insure that their aircraft transponder is operating on an appropriate or ATC assigned VFR/IFR code and MODE C when operating in such airspace. If in doubt about the operational status of either feature of your transponder while airborne, contact the nearest ATC facility or FSS and they will advise you what facility you should contact for determining the status of your equipment. In-flight requests for "immediate" deviation may be approved by controllers only when the flight will continue IFR or when weather conditions prevent VFR descent and continued VFR flight in airspace not affected by the FAR. All other requests for deviation should be made by contacting the nearest Flight Service or Air Traffic facility in person or by telephone. The nearest ARTCC will normally be the controlling agency and is responsible for coordinating requests involving deviations in other ARTCC areas.

g. TRANSPONDER OPERATION UNDER VISUAL FLIGHT RULES (VFR)

(1) Unless otherwise instructed by an Air Traffic Control Facility, adjust Transponder to reply on MODE 3/A code 1200 regardless of altitude.

(2) Adjust transponder to reply on MODE C, with altitude reporting *capability activated* if the aircraft is so equipped, unless deactivation is directed by ATC or unless the installed equipment has not been tested and calibrated as required by FAR—91.36. If deactivation is required and your transponder is so designed, turn off the altitude reporting switch and continue to transmit MODE C framing pulses. If this capability does not exist, turn off MODE C.

h. RADAR BEACON PHRASEOLOGY

Air traffic controllers, both civil and military, will use the following phraseology when referring to operation of the Air Traffic Control Radar Beacon System (ATCRBS). Instructions by ATC refer only to MODE A/3 or MODE C operation and do not affect the operation of the transponder on other MODEs.

(1) **SQUAWK (number)** — Operate radar beacon transponder on designated code in MODE A/3.

(2) **IDENT** — Engage the "IDENT" feature (military I/P) of the transponder.

(3) **SQUAWK (number) and IDENT** — Operate transponder on specified code in MODE A/3 and engage the "IDENT" (military I/P) feature.

(4) **SQUAWK STANDBY** — Switch transponder to standby position.

(5) **SQUAWK LOW/NORMAL** — Operate transponder on low or normal sensitivity as specified. Transponder is operated in "NORMAL" position unless ATC specifies "LOW", ("ON" is used instead of "NORMAL" as a master control label on some types of transponders.)

(6) **SQUAWK ALTITUDE** — Activate MODE C with automatic altitude reporting.

(7) **STOP ALTITUDE SQUAWK** — Turn off altitude reporting switch and continue transmitting MODE C framing pulses. If your equipment does not have this capability, turn off MODE C.

(8) **STOP SQUAWK (mode in use)** — Switch off specified mode. (Used for military aircraft when the controller is unaware of military service requirements for the aircraft to continue operation on another MODE.)

(9) **STOP SQUAWK** — Switch off transponder.

(10) **SQUAWK MAYDAY** — Operate transponder in the emergency position (MODE A Code 7700 for civil transponder. MODE 3 Code 7700 and emergency feature for military transponder.)

171. HAZARDOUS AREA REPORTING SERVICE

a. Selected FSSs provide flight monitoring where regularly traveled VFR routes cross large bodies of water, swamps, and mountains. This service is provided for the purpose of expeditiously alerting Search and Rescue facilities when required.

(1) When requesting the service either in person, by telephone or by radio, pilots should be prepared to give the following information — type of aircraft, altitude, indicated airspeed, present position, route of flight, heading.

(2) Radio contacts are desired at least every 10 minutes. If contact is lost for more than 15 minutes, Search and Rescue will be alerted. Pilots are responsible for cancelling their request for service when they are outside the service area boundary. Pilots experiencing two-way radio failure are expected to land as soon as practicable and cancel their request for the service. The accompaning illustration titled "LAKE, ISLAND, MOUNTAIN AND SWAMP REPORTING SERVICE" depicts the areas and the FSS facilities involved in this program.

b. LONG ISLAND SOUND REPORTING SERVICE

The New York and Bridgeport AFSSs provide Long Island Sound Reporting service on request for aircraft traversing Long Island Sound.

(1) When requesting the service pilots should ask for SOUND REPORTING SERVICE and should be prepared to provide the following appropriate information:

(a) Type and color of aircraft,

(b) The specific route and altitude across the sound including the shore crossing point,

(c) The overwater crossing time,

(d) Number of persons on board,

(e) True air speed.

(2) Radio contacts are desired at least every 10 minutes, however, for flights of shorter duration a midsound report is requested. If contact is lost for more than 15 minutes Search and Rescue will be alerted. Pilots are responsible for cancelling their request for the Long Island Sound Reporting Service when outside the service area boundary. Aircraft experiencing radio failure will be expected to land as soon as practicable and cancel their request for the service.

(3) COMMUNICATIONS: Primary communications—pilots are to transmit on 122.1 MHz and listen on one of the following VOR frequencies:

(a) NEW YORK AFSS CONTROLS:

1. Hampton VORTAC (FSS transmits on 113.6 and receives on 122.1 MHz).

2. Calverton VORTAC (FSS transmits on 117.2 and receives on standard FSS frequencies).

3. Kennedy VORTAC (FSS transmits on 115.9 and receives on 122.1 MHz).

(b) BRIDGEPORT AFSS CONTROLS:

1. Madison VORTAC (FSS transmits on 110.4 and receives on 122.1 MHz).

2. Trumbull VOR (FSS transmits on 111.8 and receives on 122.1 MHz).

3. Bridgeport VOR (FSS transmits on 108.8 and receives on 122.1 MHz).

c. BLOCK ISLAND REPORTING SERVICE

Within the Long Island Reporting Service, the New York FSS also provides an additional service for aircraft operating between Montauk Point and Block Island. When requesting this service, pilots should ask for BLOCK ISLAND REPORTING SERVICE and should be prepared to provide the same flight information as required for the Long Island Sound Reporting Service.

(1) A minimum of three position reports are mandatory for this service; these are:

(a) Reporting leaving either Montauk Point or Block Island.

(b) Midway report.

(c) Report when over either Montauk Point or Block Island. At this time, the overwater service is cancelled.

(2) COMMUNICATIONS: Pilots are to transmit on 122.1 MHz and listen on the Hampton VORTAC (HTO) frequency 113.6 MHz.

NOTE.— Pilots are advised that 122.1 MHz is a remote receiver located at the Hampton VORTAC site and designed to provide radio coverage between Hampton and Block Island. Flights proceeding beyond Block Island may contact the Bridgeport AFSS by transmitting on 122.1 MHz and listening on Trumbull VOR (TMU frequency 111.8 MHz.

d. CAPE COD AND ISLANDS RADAR OVERWATER FLIGHT FOLLOWING

In addition to normal VFR radar advisory services, traffic permitting, Otis Approach Control provides a radar overwater flight following service for aircraft traversing the Cape Cod and adjacent Island area. Pilots desiring this service may contact Otis RAPCON on 118.2 MHz.

(1) Pilots requesting this service should be prepared to give the following information:

(a) type and color of aircraft,

(b) altitude,

(c) position and heading,

(d) route of flight, and

(e) true airspeed.

(2) For best radar coverage, pilots are encouraged to fly at 1,500 feet MSL or above.

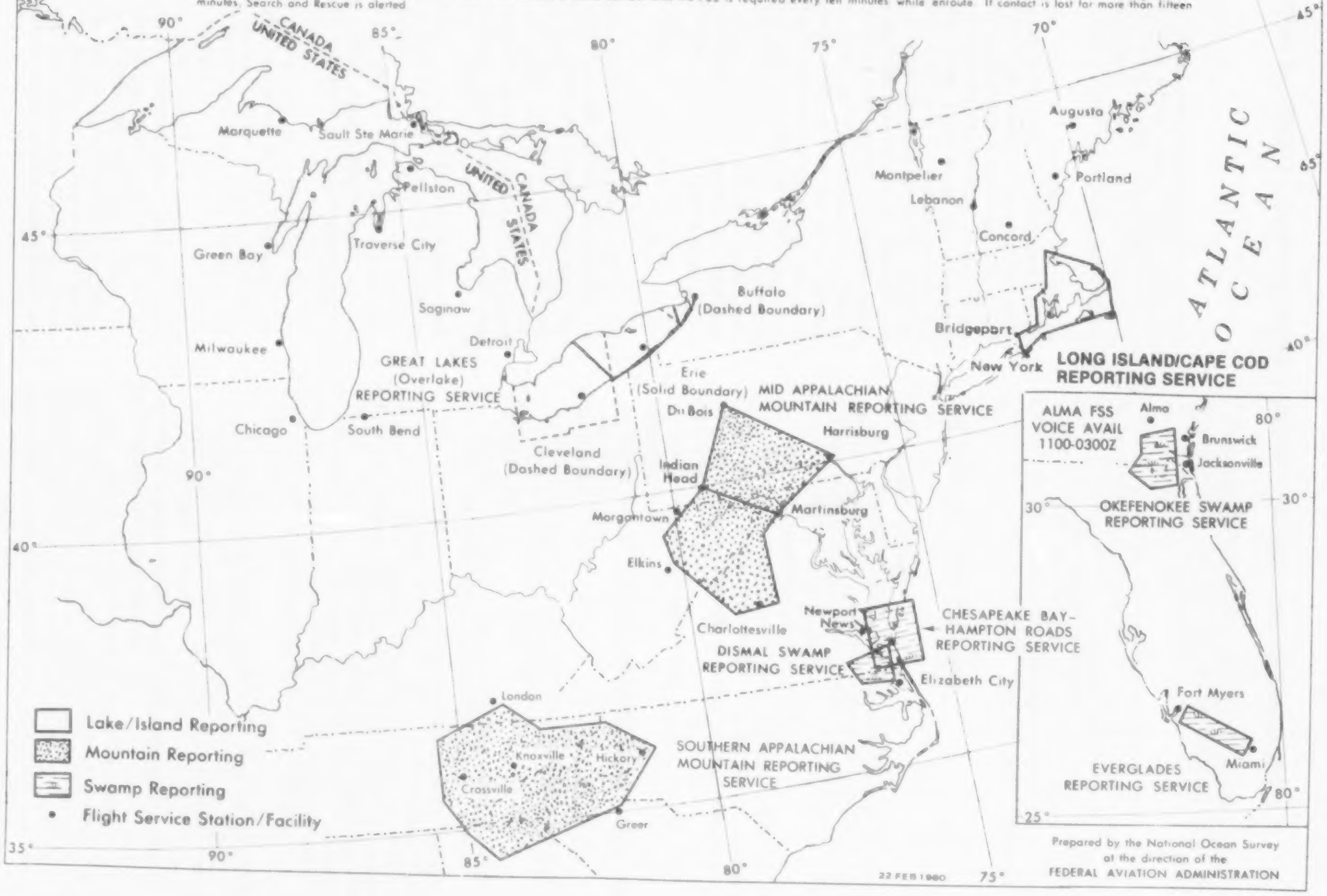
(3) Pilots are responsible for cancelling their request for overwater flight following when they are over the mainland and/or outside the service area boundary.

172—189. RESERVED

LAKE/ISLAND, MOUNTAIN AND SWAMP REPORTING SERVICE

Flight Service Station (FSS)

This service provides flight monitoring where regularly traveled VFR routes cross large bodies of water, swamps, and mountains, for the purpose of expeditiously alerting Search and Rescue facilities when required. Areas covered, associated Flight Service Stations, and the name of the service, "Stoneface", "Overlake" etc., are indicated on the following charts. To obtain this service, contact the FSS by telephone or radio giving present position, type aircraft, altitude, indicated air speed, proposed route of flight, and mainland estimate. After these arrangements have been made, a radio contact with the FSS is required every ten minutes while enroute. If contact is lost for more than fifteen minutes, Search and Rescue is alerted.



90°
85°
80°
75°
70°
65°
45°
40°
35°
CANADA
UNITED STATES
Marquette
Sault Ste Marie
Pellston
Green Bay
Traverse City
Saginaw
Milwaukee
Detroit
GREAT LAKES (Overlake) REPORTING SERVICE
Chicago
South Bend
Cleveland (Dashed Boundary)
Buffalo (Dashed Boundary)
Erie (Solid Boundary)
Du Bois
Indian Head
Morgantown
Elkins
Charlottesville
MID APPALACHIAN MOUNTAIN REPORTING SERVICE
Harrisburg
Martinsburg
Montpelier
Lebanon
Concord
Augusta
Portland
Bridgeport
New York
ATLANTIC OCEAN
LONG ISLAND/CAPE COD REPORTING SERVICE
Newport News
CHESAPEAKE BAY-HAMPTON ROADS REPORTING SERVICE
DISMAL SWAMP REPORTING SERVICE
Elizabeth City
London
Knoxville
Hickory
Crossville
Greer
SOUTHERN APPALACHIAN MOUNTAIN REPORTING SERVICE
ALMA FSS VOICE AVAIL 1100-0300Z
Alma
Brunswick
Jacksonville
OKEFENOKEE SWAMP REPORTING SERVICE
30°
25°
Fort Myers
Miami
EVERGLADES REPORTING SERVICE
22 FEB 1980
Lake/Island Reporting
Mountain Reporting
Swamp Reporting
Flight Service Station/Facility

Prepared by the National Ocean Survey
at the direction of the
FEDERAL AVIATION ADMINISTRATION

NOTES

Section 2. RADIO COMMUNICATIONS PHRASEOLOGY AND TECHNIQUES

190. GENERAL

a. Radio communications are a critical link in the ATC system. The link can be a strong bond between pilot and controller or it can be broken with surprising speed and disastrous results. Discussion herein provides basic procedures for new pilots and also highlights safe operating concepts for all pilots.

b. The single, most important thought in pilot-controller communications is understanding. It is essential, therefore, that pilots acknowledge each radio communication with ATC by using the appropriate aircraft call sign. Brevity is important, and contacts should be kept as brief as possible, but the controller must know what you want to do before he can properly carry out his control duties. And you, the pilot, must know exactly what he wants you to do. Since concise phraseology may not always be adequate, use whatever words are necessary to get your message across.

c. All pilots will find the Pilot/Controller Glossary very helpful in learning what certain words or phrases mean. Good phraseology enhances safety and is the mark of a professional pilot. Jargon, chatter and "CB" slang have no place in ATC communications. The Pilot/Controller Glossary is the same glossary used in the ATC controller's handbook. We recommend that it be studied and reviewed from time to time tosharpen your communication skills.

191. RADIO TECHNIQUE

a. *Listen* before you transmit. Many times you can get the information you want through ATIS or by monitoring the frequency. Except for a few situations where some frequency overlap occurs, if you hear someone else talking, the keying of your transmitter will be futile and you will probably jam their receivers causing them to repeat their call. If you have just changed frequencies, pause, listen and make sure the frequency is clear.

b. *Think* before keying your transmitter. Know what you want to say and if it is lengthy, e.g., a flight plan or IFR position report, jot it down.

c. The microphone should be very close to your lips and after pressing the mike button, a slight pause may be necessary to be sure the first word is transmitted. Speak in a normal conversational tone.

d. When you release the button, wait a few seconds before calling again. The controller or FSS specialist may be jotting down your number, looking for your flight plan, transmitting on a different frequency, or selecting his transmitter to your frequency.

e. Be alert to the sounds *or lack of sounds* in your receiver. Check your volume, recheck your frequency and *make sure that your microphone is not stuck* in the transmit position. Frequency blockage can, and has, occurred for extended periods of time due to unintentional transmitter operation. This type of interference is commonly referred to as a "stuck mike," and controllers may refer to it in this manner when attempting to assign an alternate frequency. If the assigned frequency is completely blocked by this type of interference, use the procedures described for en route IFR radio frequency outage, to establish or reestablish communications with ATC.

f. Be sure that you are within the performance range of your radio equipment and the ground station equipment. Remote radio sites do not always transmit and receive on all of a facilities available frequencies, particularly with regard to VOR sites where you can hear but not reach a ground station's receiver. Remember that higher altitude increases the range of VHF "line of sight" communications.

192. CONTACT PROCEDURES

a. Initial Contact.

(1) The term initial contact or initial callup means the first radio call you make to a given facility, or the first call to a different controller or FSS specialist within a facility. *Use the following format:*

(a) name of facility being called,

(b) your *full* aircraft identification as filed in the flight plan or as discussed under Aircraft Call Signs below,

(c) type of message to follow or your request if it is short, and

(d) the word "Over", if required.

EXAMPLE:

"NEW YORK RADIO, MOONEY THREE ONE ONE ECHO."

EXAMPLE:

"COLUMBIA GROUND, CESSNA THREE ONE SIX ZERO FOXTROT, IFR MEMPHIS."

EXAMPLE:

"MIAMI CENTER BARON FIVE SIX THREE HOTEL, REQUEST VFR TRAFFIC ADVISORIES."

(2) If radio reception is reasonably assured, inclusion of your request, your position or altitude, the phrase "Have numbers" or "Information Charlie received" (for ATIS) in the initial contact helps decrease radio frequency congestion. Use discretion and do not overload the controller with information he does not need. If you do not get a response from the ground station, recheck your radios or use another transmitter but keep the next contact short.

EXAMPLE:

"ATLANTA CENTER, DUKE FOUR ONE ROMEO, REQUEST VFR TRAFFIC ADVISORIES, TWENTY NORTHWEST ROME, SEVEN THOUSAND FIVE HUNDRED, OVER."

b. Initial Contact When your Transmitting and Receiving Frequencies are Different.

(1) If you are attempting to establish contact with a ground station and you are receiving on a different frequency than that transmitted, indicate the VOR name or the frequency on which you expect a reply. Most FSSs and control facilities can transmit on several VOR stations in the area. Use the appropriate FSS call sign as indicated on charts.

EXAMPLE:

New York FSS transmits on the Kennedy, Hampton and Calverton VORTACs. If you are in the Calverton area, your callup should be "NEW YORK RADIO, CESSNA THREE ONE SIX ZERO FOXTROT, RECEIVING CALVERTON VOR, OVER."

(2) If the chart indicates FSS frequencies above the VORTAC or in FSS communications boxes, transmit or receive on those frequencies nearest your location.

(3) When unable to establish contact and you wish to call *any* ground station, use the phrase "ANY RADIO (tower) (station), GIVE CESSNA THREE ONE SIX ZERO FOXTROT A CALL ON (frequency) OR (VOR)." If an emergency exists or you need assistance, so state.

c. Subsequent Contacts and Responses to Callup from a Ground Facility.

Use the same format as used for initial contact except you should state your message or request with the callup in one transmission. The ground station name and the word "Over" may be omitted if the message requires an obvious reply and there is no possibility for misunderstandings. *You should acknowledge all callups or clearances* unless the controller or FSS specialist advises otherwise. There are some occasions when the controller must issue time-critical instructions to other aircraft and he may be in a position to observe your response, either visually or on radar. If the situation demands your response, take appropriate action or immediately advise the facility of any problem. Acknowledgement is made with one of the words "Wilco, Roger, Affirmative, Negative" or other appropriate remarks (e.g., "PIPER TWO ONE FOUR LIMA, ROGER"). If you have been receiving services (e.g., VFR traffic advisories and you are leaving the area or changing frequencies), advise the ATC facility and terminate contact.

d. Acknowledgement of Frequency Changes.

(1) When advised by ATC to change frequencies, acknowledge the instruction. If you select the new frequency without an acknowledgement, the controller's workload is increased because he has no way of knowing whether you received the instruction or have had radio communications failure.

(2) At times, a controller/specialist may be working a sector with multiple frequency assignments. In order to eliminate unnecessary verbiage and to free the controller/specialist for higher priority transmissions, the controller/specialist may request the pilot "(Identification), change to my frequency 123.4." This phrase should alert the pilot that he is only changing frequencies, not controller/specialist, and that initial call up phraseology may be abbreviated.

EXAMPLE:

"UNITED 222 ON 123.4."

e. Compliance with Frequency Changes.

When instructed by ATC to change frequencies, select the new frequency as soon as possible unless instructed to make the change at a specific time, fix, or altitude. A delay in making the change could result in an untimely receipt of important information. If you are instructed to make the frequency change at a specific time, fix, or altitude, monitor the frequency you are on until reaching the specified time, fix, or altitudes unless instructed otherwise by ATC. (See PARA—340 - ARTCC COMMUNICATIONS.)

193. AIRCRAFT CALL SIGNS

a. Precautions in the Use of Call Signs.

(1) Improper use of call signs can result in pilots executing a clearance intended for another aircraft. Call signs should *never be abbreviated on an initial contact or at any time when other aircraft call signs have similar numbers/sounds or identical letters/number* (e.g., Cessna 6132F, Cessna 1622F, Baron 123F, Cherokee 7732F, etc.).

EXAMPLE:

Assume that a controller issues an approach clearance to an aircraft at the bottom of a holding stack and an aircraft with a similar call sign (at the top of the stack) acknowledges the clearance with the last two or three numbers of his call sign. If the aircraft at the bottom of the stack did not hear the clearance and intervene, flight safety would be affected, and there would be no reason for either the controller or pilot to suspect that anything is wrong. This kind of "human factors" error can strike swiftly and is extremely difficult to rectify.

(2) Pilots; therefore, must be certain that aircraft identification is complete and clearly identified before taking action on an ATC clearance. ATC specialists will not abbreviate call signs of air carrier or other civil aircraft having authorized call signs. ATC specialists may initiate abbreviated call signs of other aircraft by using the *prefix and the last three digits/letters* of the aircraft identification after communications are established. The pilot may use the abbreviated call sign in subsequent contacts with the ATC specialist. When aware of similar/identical call signs, ATC specialists will take action to minimize errors by emphasizing certain numbers/letters, by repeating the entire call sign, repeating the prefix, or by asking pilots to use a different call sign temporarily. Pilots should use the phrase "VERIFY CLEARANCE FOR (your complete call sign)" if doubt exists concerning proper identity.

(3) Civil aircraft pilots should state the aircraft type, model or manufacturer's name followed by the digits/letters of the registration number. When the aircraft manufacturer's name or model is stated, the prefix "N" is dropped (e.g. Aztec Two Four Six Four Alpha).

EXAMPLE:

BONANZA SIX FIVE FIVE GOLF.

EXAMPLE:

BREEZY SIX ONE THREE ROMEO EXPERIMENTAL (omit "Experimental" after initial contact).

(4) Air Taxi or other commercial operators *not* having FAA authorized call signs should prefix their normal identification with the phonetic word "Tango".

EXAMPLE:

TANGO AZTEC TWO FOUR SIX FOUR ALPHA.

(5) Air carriers and commuter air carriers having FAA authorized call signs should identify themselves by stating the complete call sign, using group form for the numbers and the word "heavy" if appropriate.

EXAMPLE:

UNITED TWENTY-FIVE HEAVY.

EXAMPLE:

MIDWEST COMMUTER SEVEN ELEVEN.

(6) Military aircraft use a variety of systems including serial numbers, word call signs and combinations of letters/numbers. Examples include Army Copter 48931, Air Force 61782, MAC 31792, Pat 157, Air Evac 17652, Navy Golf Alfa Kilo 21, Marine 4 Charlie 36, etc.

b. Air Ambulance Flights.

(1) Civilian air ambulance flights responding to medical emergencies (carrying patients, organ donors, organs, or other urgently needed lifesaving medical material) will be expedited by ATC when necessary. When expeditious handling is required, add the word "LIFEGUARD" in the remarks of the flight plan. In radio communication, use the call sign "LIFEGUARD" followed by the aircraft type and registration letters/numbers. When requested by the pilot, necessary notification to expedite ground handling of patients, etc., is provided by ATC; however, when possible, this information should be passed in advance through non-ATC communications systems. Extreme discretion is necessary in using the term "LIFEGUARD." It is intended only for those missions of an urgent medical nature and for use only for that portion of the flight requiring expedited handling.

(2) Similar provisions have been made for the use of "AIR EVAC" and "MED EVAC" by military air ambulance flights, except that these military flights will receive priority handling only when specifically requested.

EXAMPLE:

LIFEGUARD CESSNA TWO SIX FOUR SIX.

c. Student Pilots Radio Identification.

(1) The FAA desires to help the student pilot in acquiring sufficient practical experience in the environment in which he will be required to operate. To receive additional assistance while operating in areas of concentrated air traffic, a student pilot need only identify himself as a student pilot during his initial call to an FAA radio facility.

EXAMPLE:

DAYTON TOWER, THIS IS FLEETWING 1234, STUDENT PILOT.

(2) This special identification will alert FAA ATC personnel and enable them to provide the student pilot with such extra assistance and consideration as he may need. This procedure is not mandatory.

194. DESCRIPTION OF INTERCHANGE OR LEASED AIRCRAFT

a. Controllers issue traffic information based on familiarity with airline equipment and color/markings. When an air carrier dispatches a flight using another company's equipment and the pilot does not advise the terminal ATC facility, the possible confusion in aircraft identification can compromise safety.

b. Pilots flying an "interchange" or "leased" aircraft not bearing the colors/markings of the company operating the aircraft should inform the terminal ATC facility on first contact the name of the operating company and trip number, followed by the company name as displayed on the aircraft, and aircraft type.

EXAMPLE:

AIR CAL 311, UNITED (INTERCHANGE/LEASE), BOEING 727.

195. GROUND STATION CALL SIGNS

Pilots, when calling a ground station, should begin with the name of the facility being called followed by the type of the facility being called, as indicated in the following examples.

Airport Unicom	"Shannon Unicom"
FAA Flight Service Station	"Chicago Radio"
FAA Flight Service Station (En Route Flight Advisory Service (Weather)	"Seattle Flight Watch"
Airport Traffic Control Tower	"Augusta Tower"
Clearance Delivery Position (IFR)	"Dallas Clearance Delivery"
Ground Control Position in Tower	"Miami Ground"
Radar or Nonradar Approach Control Position	"Oklahoma City Approach"
Radar Departure Control Position	"St. Louis Departure"
FAA Air Route Traffic Control Center	"Washington Center"

196. PHONETIC ALPHABET

The International Civil Aviation Organization (ICAO) phonetic alphabet is used by FAA personnel when communications conditions are such that the information cannot be readily received without their use. ATC facilities may also request pilots to use phonetic letter equivalents when aircraft with similar sounding identifications are receiving communications on the same frequency. Pilots should use the phonetic alphabet when identifying their aircraft during initial contact with air traffic control facilities. Additionally use the phonetic equivalents for single letters and to spell out groups of letters or difficult words during adverse communications conditions.

CHARACTER	MORSE CODE	TELEPHONY	PHONIC (PRONUNCIATION)
A	○▭	Alfa	(AL-FAH)
B	▭○○○	Bravo	(BRAH-VOH)
C	▭○▭○	Charlie	(CHAR-LEE) or (SHAR-LEE)
D	▭○○	Delta	(DELL-TAH)
E	○	Echo	(ECK-OH)
F	○○▭○	Foxtrot	(FOKS-TROT)
G	▭▭○	Golf	(GOLF)
H	○○○○	Hotel	(HOH-TEL)

CHARACTER	MORSE CODE	TELEPHONY	PHONIC (PRONUNCIATION)
I	··	India	(IN-DEE-AH)
J	·−−−	Juliett	(JEW-LEE-ETT)
K	−·−	Kilo	(KEY-LOH)
L	·−··	Lima	(LEE-MAH)
M	−−	Mike	(MIKE)
N	−·	November	(NO-VEM-BER)
O	−−−	Oscar	(OSS-CAH)
P	·−−·	Papa	(PAH-PAH)
Q	−−·−	Quebec	(KEH-BECK)
R	·−·	Romeo	(ROW-ME-OH)
S	···	Sierra	(SEE-AIR-RAH)
T	−	Tango	(TANG-GO)
U	··−	Uniform	(YOU-NEE-FORM) or (OO-NEE-FORM)
V	···−	Victor	(VIK-TAH)
W	·−−	Whiskey	(WISS-KEY)
X	−··−	Xray	(ECKS-RAY)
Y	−·−−	Yankee	(YANG-KEY)
Z	−−··	Zulu	(ZOO-LOO)
1	·−−−−	One	(WUN)
2	··−−−	Two	(TOO)
3	···−−	Three	(TREE)
4	····−	Four	(FOW-ER)
5	·····	Five	(FIFE)
6	−····	Six	(SIX)
7	−−···	Seven	(SEV-EN)
8	−−−··	Eight	(AIT)
9	−−−−·	Nine	(NIN-ER)
0	−−−−−	Zero	(ZEE-RO)

197—199. RESERVED

200. FIGURES

a. Figures indicating hundred and thousands in round number, as for ceiling heights, and upper wind levels up to 9900 shall be spoken in accordance with the following:

EXAMPLE:

500..FIVE HUNDRED

EXAMPLE:

4500.................FOUR THOUSAND FIVE HUNDRED

b. Numbers above 9900 shall be spoken by separating the digits preceding the word "thousand."

EXAMPLE:

10,000.................................ONE ZERO THOUSAND

EXAMPLE:

13,500...ONE THREE THOUSAND FIVE HUNDRED

c. Transmit airway or jet route numbers as follows:

EXAMPLE:

V12.......................................VICTOR TWELVE

EXAMPLE:

J533.................................J FIVE THIRTY-THREE

d. All other numbers shall be transmitted by pronouncing each digit.

EXAMPLE:

10..ONE ZERO

e. When a radio frequency contains a decimal point, the decimal point is spoken as "POINT."

EXAMPLE:

122.1.............................ONE TWO TWO POINT ON

NOTE.— ICAO Procedures require the decimal point be spoke as "DECIMAL" and FAA will honor such usage by military ai craft and all other aircraft required to use ICAO Procedures.

201. ALTITUDES AND FLIGHT LEVELS

a. Up to but not including 18,000 feet MSL — state th separate digits of the thousands, plus the hundreds, if appropriate.

EXAMPLE:

12,000.................................ONE TWO THOUSAN

EXAMPLE:

12,500.......ONE TWO THOUSAND FIVE HUNDRE

b. At and above, 18,000 feet MSL (FL 180) state th words "flight level" followed by the separate digits of th flight level.

EXAMPLE:

190.......................FLIGHT LEVEL ONE NINER ZERO

202. DIRECTIONS

The three digits of bearing, course, heading or wind direction should always be magnetic. The word "true" mus be added when it applies.

EXAMPLE:

(magnetic course) 005......................ZERO ZERO FIV

EXAMPLE:

(true course) 050..................ZERO FIVE ZERO TRU

EXAMPLE:

(magnetic bearing) 360.................... THREE SIX ZERO

EXAMPLE:

(magnetic heading) 100.................... ONE ZERO ZERO

EXAMPLE:

(wind direction) 220.......................... TWO TWO ZERO

203. SPEEDS

The separate digits of the speed followed by the word "KNOTS." Except, controllers may omit the word "KNOTS" when using speed adjustment procedures, e.g., "REDUCE/INCREASE SPEED TO TWO FIVE ZERO."

EXAMPLES:

(speed) 250.......................... TWO FIVE ZERO KNOTS
(speed) 190....................... ONE NINER ZERO KNOTS

The separate digits of the mach number preceded by "MACH."

EXAMPLES:

(mach number) 1.5............. MACH ONE POINT FIVE
(mach number) .64............... MACH POINT SIX FOUR
(mach number) .7..................... MACH POINT SEVEN

204. TIME

a. FAA uses Coordinated Universal Time (UTC) for all operations. The term "Zulu" is used when ATC procedures require a reference to UTC.

EXAMPLE:

0920...................................... ZERO NINER TWO ZERO

b. To Convert from Standard Time to Coordinated Universal Time:

Eastern Standard Time	Add 5 hours
Central Standard Time	Add 6 hours
Mountain Standard Time	Add 7 hours
Pacific Standard Time	Add 8 hours

NOTE.— For Daylight Time subtract 1 hour.

c. The 24-hour clock system is used in radiotelephone transmissions. The hour is indicated by the first two figures and the minutes by the last two figures.

EXAMPLE:

0000.. ZERO ZERO ZERO ZERO

EXAMPLE:

0920...................................... ZERO NINER TWO ZERO

d. Time may be stated in minutes only (two figures) in radio telephone communications when no misunderstanding is likely to occur.

e. Current time in use at a station is stated in the nearest quarter minute in order that pilots may use this information for time checks. Fractions of a quarter minute less than eight seconds are stated as the preceding quarter minute; fractions of a quarter minute of eight seconds or more are stated as the succeeding quarter minute.

EXAMPLE:

0929:05.................. TIME, ZERO NINER TWO NINER

EXAMPLE:

0929:10...TIME, ZERO NINER TWO NINER AND ONE-QUARTER

205. COMMUNICATIONS WITH TOWER WHEN AIRCRAFT TRANSMITTER OR RECEIVER OR BOTH ARE INOPERATIVE

a. Arriving Aircraft

(1) Receiver inoperative — If you have reason to believe your receiver is inoperative, remain outside or above the airport traffic area until the direction and flow of traffic has been determined, then advise the tower of your type aircraft, position, altitude, intention to land and request that you be controlled with light signals. (See PARA—233 - TRAFFIC CONTROL OF LIGHT SIGNALS.) When you are approximately 3 to 5 miles from the airport, advise the tower of your position and join the airport traffic pattern. From this point on, watch the tower for light signals. Thereafter, if a complete pattern is made, transmit your position downwind and/or turning base leg.

(2) Transmitter inoperative — Remain outside or above the airport traffic area until the direction and flow of traffic has been determined, then join the airport traffic pattern. Monitor the primary local control frequency as depicted on Sectional Charts for landing or traffic information, and look for a light signal which may be addressed to your aircraft. During hours of daylight, acknowledge tower transmissions or light signals by rocking your wings. At night, acknowledge by blinking the landing or navigation lights. To acknowledge tower transmissions during daylight hours, hovering helicopters will turn in the direction of the controlling facility and flash the landing light. While in flight, helicopters should show their acknowledgement of receiving a transmission by making shallow banks in opposite directions. At night, helicopters will acknowledge receipt of transmissions by flashing either the landing or the search light.

(3) Transmitter and receiver inoperative — Remain outside or above the airport traffic area until the direction and flow of traffic has been determined, then join the airport traffic pattern and maintain visual contact with the tower to receive light signals. Acknowledge light signals as noted above.

b. Departing Aircraft

(1) If you experience radio failure prior to leaving the parking area, make every effort to have the equipment repaired. If you are unable to have the malfunction repaired, call the tower by telephone and request authorization to depart without two-way radio communications. If tower authorization is granted, you will be given departure information and requested to monitor the tower frequency or watch for light signals, as appropriate. During daylight hours, acknowledge tower transmissions or light signals by moving the ailerons or rudder. At night, acknowledge by blinking the landing or navigation lights. If radio malfunction occurs after departing the parking area, watch the tower for light signals or monitor tower frequency.

NOTE.— Refer to FAR—91.87 and FAR—91.77.

206. COMMUNICATIONS FOR VFR FLIGHTS

a. FSSs are allocated frequencies for different functions, for Airport Advisory Service the pilot should contact the FSS on 123.6 MHz, for example. Other FSS frequencies are listed with the FSS in the Airport/Facility Directory. If you are in doubt as to what frequency to use to contact an FSS, transmit on 122.1 MHz and advise them of the frequency you are receiving on.

b. On VFR flights, guard the voice channel of VORs for broadcasts and calls from FAA FSSs. Where the VOR voice channel is being utilized for ATIS broadcasts, pilots of VFR flights are urged to guard the voice channel of an adjacent VOR. When in contact with a control facility notify the controller if you plan to leave the frequency.

207—219. RESERVED

Section 3. AIRPORT OPERATIONS

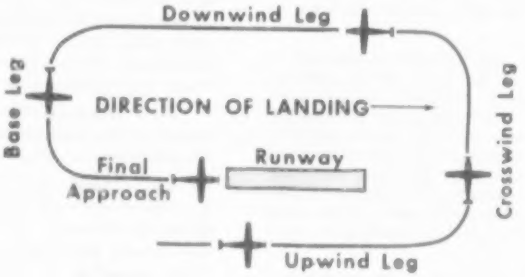
220. GENERAL

Increased traffic congestion, aircraft in climb and descent attitudes, and pilots preoccupation with cockpit duties are some factors that increase the hazardous accident potential near the airport. The situation is further compounded when the weather is marginal — that is, just meeting VFR requirements. Pilots must be particularly alert when operating in the vicinity of an airport. This section defines some rules, practices and procedures that pilots should be familiar with, and adhere to, for safe airport operations.

221. TOWER CONTROLLED AIRPORTS

a. When operating at an airport where traffic control is being exercised by a control tower, pilots are required to maintain two-way radio contact with the tower while operating within the airport traffic area unless the tower authorizes otherwise. Initial call-up should be made about 15 miles from the airport. Unless there is a good reason to leave the tower frequency before exiting the airport traffic area it is a good operating practice to remain on the tower frequency for the purpose of receiving traffic information. In the interest of reducing tower frequency congestion, pilots are reminded that it is not necessary to request permission to leave the tower frequency once outside of the airport traffic area.

b. When necessary, the tower controller will issue clearances or other information for aircraft to generally follow the desired flight path (traffic patterns) when flying in the airport traffic area/control zone, and the proper taxi routes when operating on the ground. If not otherwise authorized or directed by the tower, pilots of fixed-wing aircraft approaching to land must circle the airport to the left. Pilots approaching to land in a helicopter must avoid the flow of fixed-wing traffic. However, in all instances, an appropriate clearance must be received from the tower before landing.



NOTE.— This diagram is intended only to illustrate terminology used in identifying various components of a traffic pattern. It should not be used as a reference or guide on how to enter a traffic pattern.

c. The following terminology for the various components of a traffic pattern has been adopted as standard for use by control towers and pilots:

(1) Upwind leg — A flight path parallel to the landing runway in the direction of landing.

(2) Crosswind leg — A flight path at right angles to the landing runway off its takeoff end.

(3) Downwind leg — A flight path parallel to the landing runway in the opposite direction of landing.

(4) Base leg — A flight path at right angles to the landing runway off its approach end and extending from the downwind leg to the intersection of the extended runway centerline.

(5) Final approach — A flight path in the direction of landing along the extended runway centerline from the base leg to the runway.

d. Many towers are equipped with a tower radar display. The radar uses are intended to enhance the effectiveness and efficiency of the local control, or tower, position. They are not intended to provide radar services or benefits to pilots except as they may accrue through a more efficient tower operation. The four basic uses are:

(1) To determine an aircraft's exact location —This is accomplished by radar identifying the VFR aircraft through any of the techniques available to a radar position; such as having the aircraft ident. Once identified, the aircraft's position and spatial relationship to other aircraft can be quickly determined and standard instructions regarding VFR operation in the airport traffic area will be issued. Once initial radar identification of a VFR aircraft has been established and the appropriate instructions have been issued, radar monitoring may be discontinued. The reason being that the local controller's primary means of surveillance in VFR conditions is visually scanning the airport and local area.

(2) To provide radar traffic advisories —Radar traffic advisories may be provided to the extent that the local controller is able to monitor the radar display. Local control has primary control responsibilities to the aircraft operating on the runways which will normally supersede radar monitoring duties.

(3) To provide a direction or suggested heading — The local controller may provide pilots flying VFR with generalized instructions which will facilitate operations (e.g.,"PROCEED SOUTHWEST BOUND, ENTER A RIGHT DOWNWIND RUNWAY THREE ZERO"); or provide a suggested heading to establish radar identification or as an advisory aid to navigation (e.g., "SUGGESTED HEADING TWO TWO ZERO, FOR RADAR IDENTIFICATION"). In both cases, the instructions are advisory aids to the pilot flying VFR and are not radar vectors. PILOTS HAVE COMPLETE DISCRETION REGARDING ACCEPTANCE OF THE SUGGESTED HEADING OR DIRECTION AND HAVE SOLE RESPONSIBILITY FOR SEEING AND AVOIDING OTHER AIRCRAFT.

(4) To provide information and instructions to aircraft operating within the airport traffic area —In an example of this situation, the local controller would use the radar to advise a pilot on an extended downwind when to turn base leg.

NOTE.— The above tower radar applications are intended to augment the standard functions of the local control position. There is no controller requirement to maintain constant radar identification and, in fact, such a requirement could compromise the local controllers ability to visually scan the airport and local area to meet FAA responsibilities to the aircraft operating on the runways and within the airport traffic area. Normally, pilots will not be advised of being in radar contact since that continued status cannot be guaranteed and since the purpose of the radar identification is not to establish a link for the provision of radar services.

e. A few of the radar equipped towers are authorized to use the radar to ensure separation between aircraft in specific situations, while still others may function as limited radar approach controls. The various radar uses are strictly a function of FAA operational need. The facilities may be indistinguishable to pilots since they are all referred to as tower and no publication lists the degree of radar use. Therefore, WHEN IN COMMUNICATION WITH A TOWER CONTROLLER WHO MAY HAVE RADAR AVAILABLE, DO NOT ASSUME THAT CONSTANT RADAR MONITORING AND COMPLETE ATC RADAR SERVICES ARE BEING PROVIDED.

222. VISUAL INDICATORS AT UNCONTROLLED AIRPORTS

a. At those airports *without an operating control tower*, a segmented circle visual indicator system, if installed, is designed to provide traffic pattern information. (See PARA—157 - TRAFFIC ADVISORY PRACTICES AT AIRPORTS WHERE A TOWER IS NOT IN OPERATION). The segmented circle system consists of the following components:

(1) The segmented circle — Located in a position affording maximum visibility to pilots in the air and on the ground and providing a centralized location for other elements of the system.

(2) The Wind Direction Indicator — A wind cone, wind sock, or wind tee installed near the operational runway to indicate wind direction. The large end of the wind cone/wind sock points into the wind as does the large end (cross bar) of the wind tee. In lieu of a tetrahedron and where a wind sock or wind cone is collocated with a wind tee, the wind tee may be manually aligned with the runway in use to indicate landing direction. These signaling devices may be located in the center of the segmented circle and may be lighted for night use. Pilots are cautioned against using a tetrahedron to indicate wind direction.

(3) The Landing Direction Indicator — A tetrahedron is installed when conditions at the airport warrant its use. It may be used to indicate the direction of landings and takeoffs. A tetrahedron may be located at the center of a segmented circle and may be lighted for night operations. The small end of the tetrahedron points in the direction of landing. Pilots are cautioned against using a tetrahedron for any purpose other than as an indicator of landing direction. Further, pilots should use extreme caution when making runway selection by use of a tetrahedron in very light or calm wind conditions as the tetrahedron may not be aligned with the designated calm-wind runway. At airports with control towers, the tetrahedron should only be referenced when the control tower is not in operation. Tower instructions supersede tetrahedron indications.

(4) Landing strip indicators — Installed in pairs as shown in the segmented circle diagram and used to show the alignment of landing strips.

(5) Traffic pattern indicators — Arranged in pairs in conjunction with landing strip indicators and used to indicate the direction of turns when there is a variation from the normal left traffic pattern. (If there is no segmented circle installed at the airport, traffic pattern indicators may be installed on or near the end of the runway.)

b. Preparatory to landing at an airport without a control tower, or when the control tower is not in operation, the pilot should concern himself with the indicator for the approach end of the runway to be used. When approaching for landing, all turns must be made to the left unless a traffic pattern indicator indicates that turns should be made to the right. If the pilot will mentally enlarge the indicator for the runway to be used, the base and final approach legs of the traffic pattern to be flown immediately become apparent. Similar treatment of the indicator at the departure end of the runway will clearly indicate the direction of turn after takeoff.

c. When two or more aircraft are approaching an airport for the purpose of landing, the aircraft at the lower altitude has the right of way, but it shall not take advantage of this rule to cut in front of another which is on final approach to land, or to overtake that aircraft (FAR-91.67(f)).

223. TRAFFIC PATTERNS

At most airports and military air bases, traffic pattern altitudes for propeller driven aircraft generally extend from 600 feet to as high as 1,500 feet above the ground. Also, traffic pattern altitudes for military turbojet aircraft sometimes extend up to 2,500 feet above the ground. Therefore, pilots of en route aircraft should be constantly on the alert for other aircraft in traffic patterns and avoid these areas whenever possible. Traffic pattern altitudes should be maintained unless otherwise required by the applicable distance from cloud criteria (FAR—91.105).

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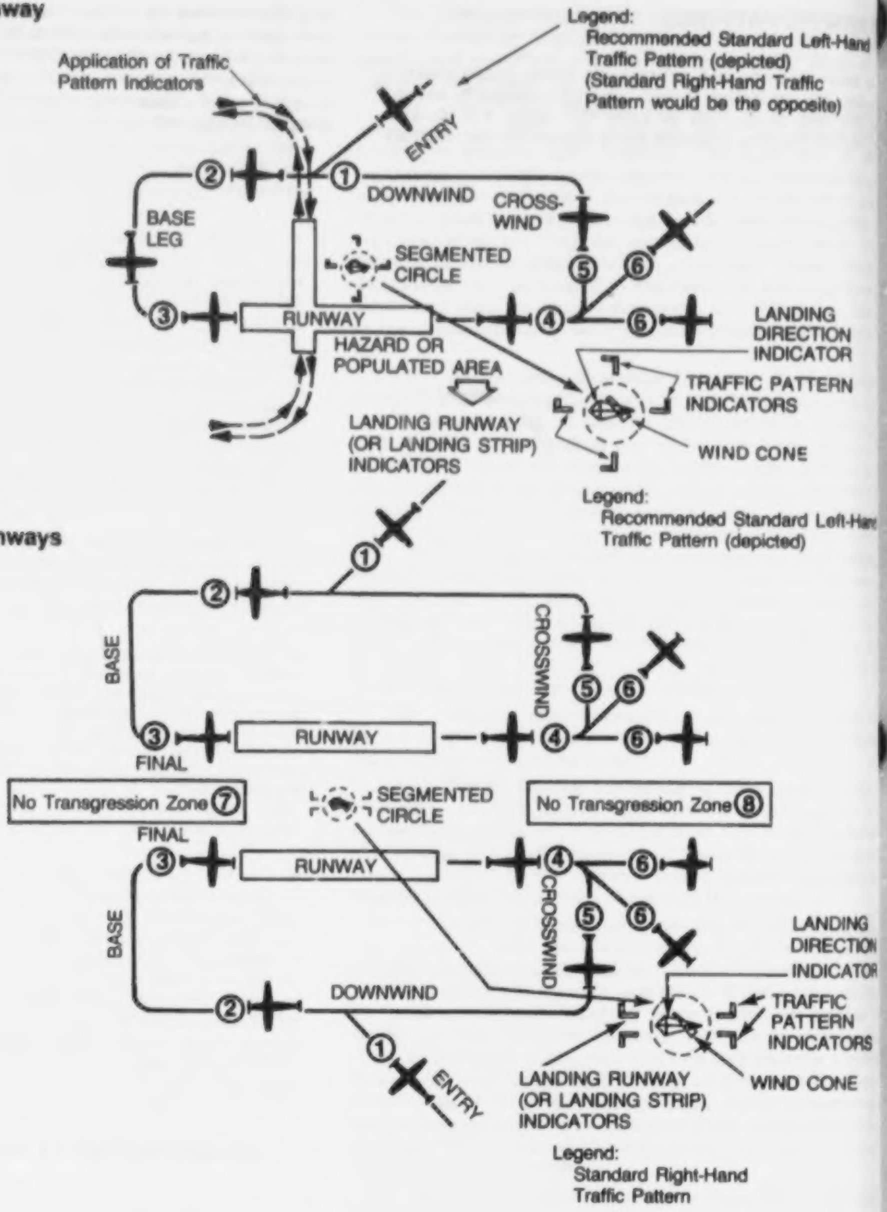
Single Runway

Parallel Runways


Legend:
Recommended Standard Left-Hand Traffic Pattern (depicted)
(Standard Right-Hand Traffic Pattern would be the opposite)
Application of Traffic Pattern Indicators
ENTRY
①
②
DOWNWIND
CROSS-WIND
BASE LEG
SEGMENTED CIRCLE
⑤
⑥
③
RUNWAY
④
⑥
LANDING DIRECTION INDICATOR
HAZARD OR POPULATED AREA
TRAFFIC PATTERN INDICATORS
LANDING RUNWAY (OR LANDING STRIP) INDICATORS
WIND CONE
Legend:
Recommended Standard Left-Hand Traffic Pattern (depicted)
①
②
CROSSWIND
BASE
⑤
⑥
③
RUNWAY
④
⑥
FINAL
No Transgression Zone ⑦
SEGMENTED CIRCLE
No Transgression Zone ⑧
FINAL
③
RUNWAY
④
⑥
CROSSWIND
BASE
⑤
⑥
LANDING DIRECTION INDICATOR
②
DOWNWIND
TRAFFIC PATTERN INDICATORS
WIND CONE
①
ENTRY
LANDING RUNWAY (OR LANDING STRIP) INDICATORS
Legend:
Standard Right-Hand Traffic Pattern

Key:

① Enter pattern in level flight, abeam the midpoint of the runway, at pattern altitude. (1000′ AGL is recommended pattern altitude unless established otherwise).

② Maintain pattern altitude until abeam approach end of the landing runway, or downwind leg.

③ Complete turn to final at least ¼ mile from the runway.

④ Continue straight ahead until beyond departure end of runway.

⑤ If remaining in the traffic pattern, commence turn to crosswind leg beyond the departure end of the runway, within 300 feet of pattern altitude.

⑥ If departing the traffic pattern, continue straight out, or exit with a 45° left turn beyond the departure end of the runway, after reaching pattern altitude.

⑦ Do not overshoot final or continue on a track which will penetrate the final approach of the parallel runway.

⑧ Do not continue on a track which will penetrate the departure path of the parallel runway.

224. UNEXPECTED MANEUVERS IN THE AIRPORT TRAFFIC PATTERN

There have been several incidents in the vicinity of controlled airports that were caused primarily by aircraft executing unexpected maneuvers. ATC service is based upon observed or known traffic and airport conditions. Controllers establish the sequence of arriving and departing aircraft by requiring them to adjust flight as necessary to achieve proper spacing. These adjustments can only be based on observed traffic, accurate pilot reports, and anticipated aircraft maneuvers. Pilots are expected to cooperate so as to preclude disruption of traffic flow or creation of conflicting patterns. The pilot in command of an aircraft is directly responsible for and is the final authority as to the operation of his aircraft. On occasion it may be necessary for a pilot to maneuver his aircraft to maintain spacing with the traffic he has been sequenced to follow. The controller can anticipate minor maneuvering such as shallow "S" turns. The controller cannot, however, anticipate a major maneuver such as a 360 degree turn. If a pilot makes a 360 degree turn after he has obtained a landing sequence, the result is usually a gap in the landing interval and more importantly it causes a chain reaction which may result in a conflict with following traffic and interruption of the sequence established by the tower or approach controller. Should a pilot decide he needs to make maneuvering turns to maintain spacing behind a preceding aircraft, he should always advise the controller if at all possible. Except when requested by the controller or in emergency situations, a 360 degree turn should never be executed in the traffic pattern or when receiving radar service without first advising the controller.

225. RESERVED

226. USE OF RUNWAYS

a. Runways are identified by numbers which indicate the nearest 10-degree increment of the azimuth of the runway centerline. For example, where the magnetic azimuth is 183 degrees, the runway designation would be 18, for a magnetic azimuth of 87 degrees, the runway designation would be 9. For a magnetic azimuth ending in the number 5, such as 185, the runway designation could be either 18 or 19. Wind direction issued by the tower is also magnetic and wind velocity is in knots.

b. Airport proprietors are responsible for taking the lead in local aviation noise control. Accordingly, they may propose specific noise abatement plans to the FAA. If approved, these plans are applied in the form of Formal or Informal Runway Use Programs (see Glossary) for noise abatement purposes.

(1) At airports where no runway use program is established, ATC clearances may specify:

(a) the runway most nearly aligned with the wind when it is 5 knots or more,

(b) the "calm wind" runway when wind is less than 5 knots, or

(c) another runway if operationally advantageous.

NOTE.— It is not necessary for a controller to specifically inquire if the pilot will use a specific runway or to offer him a choice of runways. If a pilot prefers to use a different runway than that specified or the one most nearly aligned with the wind, he is expected to inform ATC accordingly.

(2) At airports where a runway use program is established, ATC will assign runways deemed to have the least noise impact. If in the interest of safety a runway different than that specified is preferred, the pilot is expected to advise ATC accordingly. ATC will honor such requests and advise pilots when the requested runway is noise sensitive. When use of a runway other than the one assigned is requested, pilot cooperation is encouraged to preclude disruption of traffic flows or creation of conflicting patterns.

227. LOW LEVEL WIND SHEAR ALERT SYSTEM (LLWAS)

a. This computerized system detects the presence of a possible hazardous low-level wind shear by continuously comparing the winds measured by sensors installed around the periphery of an airport with the wind measured at the centerfield location. If the difference between the centerfield wind sensor and a peripheral wind sensor becomes excessive, a thunderstorm or thunderstorm gust front wind shear is probable. When this condition exists, the tower controller will provide arrival and departure aircraft with an advisory of the situation which includes the centerfield wind plus the remote site location and wind.

b. Since the sensors are not all associated with specific runways, descriptions of the remote sites will be based on an eight point compass system.

EXAMPLE:

DELTA ONE TWENTY FOUR CENTERFIELD WIND TWO SEVEN ZERO AT ONE ZERO. SOUTH BOUNDARY WIND ONE FOUR ZERO AT THREE ZERO.

c. An airport equipped with the Low Level Wind Shear Alert System is so indicated in the Airport/Facility Directory under *Weather Data Sources* for that particular airport.

228. BRAKING ACTION REPORTS

a. ATC furnishes pilots the quality of braking action received from pilots or the airport management. The quality of braking action is described by the terms "good," "fair," "poor," and "nil" or a combination of these terms. Where available from airport management numerical readings from friction measuring devices, such as Mu-Meter, Saab Friction Tester, Skidometer, and Tapley Meter will be issued at pilot's request.

b. Pilots should describe the quality of braking action by using the terms noted above. In describing braking action for a portion of a runway, pilots should use descriptive terms that are easily understood, such as, "braking action poor the first/last half of the runway." Reports reference to local landmarks, buildings, etc., should be avoided.

229. BRAKING ACTION ADVISORIES

a. When tower controllers have received runway braking action reports which include the terms*poor or nil*, or whenever weather conditions are conducive to deteriorating or rapidly changing runway braking conditions, the tower will include on the ATIS broadcast the statement,"*BRAKING ACTION ADVISORIES ARE IN EFFECT.*"

b. During the time that Braking Action Advisories are in effect, ATC will issue the latest braking action report for the runway in use to each arriving and departing aircraft. Pilots should be prepared for deteriorating braking conditions and should request current runway condition information if not volunteered by controllers. Pilots should also be prepared to provide a descriptive runway condition report to controllers after landing.

230. INTERSECTION TAKEOFFS

a. In order to enhance airport capacities, reduce taxiing distances, minimize departure delays, and provide for more efficient movement of air traffic, controllers may initiate intersection takeoffs as well as approve them when the pilot requests. If for ANY reason a pilot prefers to use a different intersection or the full length of the runway or desires to obtain the distance between the intersection and the runway end, HE IS EXPECTED TO INFORM ATC ACCORDINGLY.

b. An aircraft is expected to taxi to (but not onto) the end of the assigned runway unless prior approval for an intersection departure is received from ground control.

c. Controllers are required to separate small aircraft (12,500 pounds or less, maximum certificated takeoff weight) departing (same or opposite direction) from an intersection behind a large nonheavy aircraft on the same runway, by ensuring that at least a 3-minute interval exists between the time the preceding large aircraft has taken off and the succeeding small aircraft begins takeoff roll. To inform the pilot of the required 3-minute hold, the controller will state, "Hold for wake turbulence." If after considering wake turbulence hazards, the pilot feels that a lesser time interval is appropriate, he may request a waiver to the 3-minute interval. Pilots must initiate such a request by stating, "Request waiver to 3-minute interval," or by making a similar statement. Controllers may then issue a takeoff clearance if other traffic permits, since the pilot has accepted responsibility for his own wake turbulence separation.

d. The 3-minute interval will not be applied when the intersection is 500 feet or less from the threshold and both aircraft are taking off in the same direction. When a small aircraft is departing from an intersection 500 feet or less from the runway threshold behind a large nonheavy aircraft and both aircraft are taking off in the same direction, the 3-minute interval will not be applied. Controllers will issue a clearance to permit the small aircraft to alter course to avoid the flight path of the preceding departure.

e. The 3-minute interval is mandatory behind a heavy aircraft in all cases.

231. SIMULTANEOUS OPERATIONS ON INTERSECTING RUNWAYS

a. Despite the many new and lengthened runw which have been added to the nation's airports in rec years, limited runway availability remains a major cont uting factor to operational delays. Many high-density ports have gained operational experience with intersec runways which clearly indicates that simultaneous op ations are safe and feasible. Tower controllers may aut ize simultaneous landings or a simultaneous landing a takeoff on intersecting runways when the following con tions are met:

(1) The runways are dry and the controller has ceived no reports that braking action is less than good.

(2) A simultaneous takeoff and landing opera may be conducted only in VFR conditions between sun and sunset.

(3) Instructions are issued to restrict one airc from entering the intersecting runway being used by other aircraft.

(4) Traffic information issued is acknowledged by pilots of both aircraft.

(5) The measured distance from runway thresh intersection is issued if the pilot requests it.

(6) The conditions specified in 3, 4 and 5 are me or before issuance of the landing clearance.

(7) The distance from landing threshold to the int section is adequate for the category of aircraft being h short. Controllers are provided a general table of airc category/minimum runway length requirements as guide. Operators of STOL aircraft should identify their craft as such on initial contact with the tower, unles Letter of Agreement concerning this fact, is in effect. IT INCUMBENT ON THE PILOT TO DETERMINE ABILITY TO HOLD SHORT OF AN INTERSECTIO AFTER LANDING, WHEN SO INSTRUCTED.

(8) There is no tailwind for the landing aircraft stricted to hold short of the intersection.

b. THE SAFETY AND OPERATION OF AN AI CRAFT REMAIN THE RESPONSIBILITY OF TH PILOT. IF FOR ANY REASON, (e.g. DIFFICULTY IN DI CERNING LOCATION OF AN INTERSECTION NIGHT, INABILITY TO HOLD SHORT OF AN INTE SECTION, WIND FACTORS, ETC.) A PILOT ELECTS USE THE FULL LENGTH OF THE RUNWAY, A DI FERENT RUNWAY OR DESIRES TO OBTAIN THE DI TANCE FROM THE LANDING THRESHOLD TO TH INTERSECTION, HE IS EXPECTED TO PROMPTL INFORM ATC ACCORDINGLY.

232. LOW APPROACH

a. A low approach (sometimes referred to as a lo pass) is the go-around maneuver following approach. In stead of landing or making a touch-and-go, a pilot ma wish to go around (low approach) in order to expedite particular operation — a series of practice instrument ap proaches is an example of such an operation. Unless othe wise authorized by ATC, the low approach should be ma straight ahead, with no turns or climb made until the pi has made a thorough visual check for other aircraft in the area.

b. When operating within an airport traffic area, a pilot intending to make a low approach should contact the tower for approval. This request should be made prior to starting the final approach.

c. When operating to an airport, not within an airport traffic area, a pilot intending to make a low approach should, prior to leaving the final approach fix inbound (non precision approach) or the outer marker or fix used in lieu of the outer marker inbound (precision approach), so advise the FSS, UNICOM, or make a broadcast, as appropriate (See PARA—157 - TRAFFIC ADVISORY PRACTICES AT AIRPORTS WITHOUT OPERATING CONTROL TOWERS).

233. TRAFFIC CONTROL LIGHT SIGNALS

a. The following procedures are used by ATCTs in the control of aircraft, ground vehicles, equipment, and personnel not equipped with radio. These same procedures will be used to control aircraft, ground vehicles, equipment, and personnel equipped with radio if radio contact cannot be established. ATC personnel use a directive traffic control signal which emits an intense narrow light beam of a selected color (either red, white, or green) when controlling traffic by light signals.

b. Although the traffic signal light offers the advantage that some control may be exercised over nonradio equipped aircraft, pilots should be cognizant of the disadvantages which are:

(1) The pilot may not be looking at the control tower at the time a signal is directed toward him.

(2) The directions transmitted by a light signal are very limited since only approval or disapproval of a pilot's anticipated actions may be transmitted. No supplement or explanatory information may be transmitted except by the use of the "General Warning Signal" which advises the pilot to be on the alert.

c. Between sunset and sunrise, a pilot wishing to attract the attention of the control tower should turn on a landing light and taxi the aircraft into a position, clear of the active runway, so that light is visible to the tower. The landing light should remain on until appropriate signals are received from the tower.

d. Air Traffic Control Tower Light Gun Signals:

	MEANING		
COLOR AND TYPE OF SIGNAL	MOVEMENT OF VEHICLES EQUIPMENT AND PERSONNEL	AIRCRAFT ON THE GROUND	AIRCRAFT IN FLIGHT
Steady green	Cleared to cross, proceed or go	Cleared for takeoff	Cleared to land
Flashing green	Not applicable	Cleared for taxi	Return for landing (to be followed by steady green at the proper time)
Steady red	STOP	STOP	Give way to other aircraft and continue circling
Flashing red	Clear the taxiway/runway	Taxi clear of the runway in use	Airport unsafe, do not land
Flashing white	Return to starting point on airport	Return to starting point on airport	Not applicable
Alternating red and green	Exercise extreme caution	Exercise extreme caution	Exercise extreme caution

e. During daylight hours, acknowledge tower transmissions or light signals by moving the ailerons or rudder. At night, acknowledge by blinking the landing or navigation lights. If radio malfunction occurs after departing the parking area, watch the tower for light signals or monitor tower frequency.

234. RESERVED

235. COMMUNICATIONS

a. Pilots of departing aircraft should communicate with the control tower on the appropriate ground control/clearance delivery frequency prior to starting engines to receive engine start time, taxi and/or clearance information. Unless otherwise advised by the tower, remain on that frequency during taxiing and runup, then change to local control frequency when ready to request takeoff clearance. (See PARA. 161 - AUTOMATIC TERMINAL INFORMATION SERVICE (ATIS) for continuous broadcast of terminal information.)

b. The majority of ground control frequencies are in the 121.6—121.9 MHz bandwidth. Ground control frequencies are provided to eliminate frequency congestion on the tower (local control) frequency and are limited to communications between the tower and aircraft on the ground and between the tower and utility vehicles on the airport, provide a clear VHF channel for arriving and departing aircraft. They are used for issuance of taxi information, clear-

ances, and other necessary contacts between the tower and aircraft or other vehicles operated on the airport. A pilot who has just landed should not change from the tower frequency to the ground control frequency until he is directed to do so by the controller. Normally, only one ground control frequency is assigned at an airport; however, at locations where the amount of traffic so warrants, a second ground control frequency and/or another frequency designated as a clearance delivery frequency, may be assigned.

c. A controller may omit the ground or local control frequency if the controller believes the pilot knows which frequency is in use. If the ground control frequency is in the 121 MHz bandwidth the controller may omit the numbers preceding the decimal point; (e.g., 121.7, "CONTACT GROUND POINT SEVEN.") However, if any doubt exists as to what frequency is in use, the pilot should promptly request the controller to provide that information.

d. Controllers will normally avoid issuing a radio frequency change to helicopters, known to be single-piloted, which are hovering, air taxiing, or flying near the ground. At times, it may be necessary for pilots to alert ATC regarding single pilot operations to minimize delay of essential ATC communications. Whenever possible, ATC instructions will be relayed through the frequency being monitored until a frequency change can be accomplished. You must promptly advise ATC if you are unable to comply with a frequency change. Also, you should advise ATC if you must land to accomplish the frequency change unless it is clear the landing, e.g., on a taxiway or in a helicopter operating area, will have no impact on other air traffic.

236. GATE HOLDING DUE TO DEPARTURE DELAYS

a. Pilots should contact ground control or clearance delivery prior to starting engines as gate hold procedures will be in effect whenever departure delays exceed or are anticipated to exceed 5 minutes. The sequence for departure will be maintained in accordance with initial call up unless modified by flow control restrictions. Pilots should monitor the ground control or clearance delivery frequency for engine startup advisories or new proposed start time if the delay changes.

b. The tower controller will consider that pilots of turbine powered aircraft are ready for takeoff when they reach the runway or warm-up block unless advised otherwise.

237. VFR FLIGHTS IN TERMINAL AREAS

Use reasonable restraint in exercising the prerogative of VFR flight, especially in terminal areas. The weather minimums and distances from clouds are minimums. Giving yourself a greater margin in specific instances is just good judgment.

a. Approach Area.

Conducting a VFR operation in a Control Zone when the official visibility is 3 or 4 miles is not prohibited, but good judgment would dictate that you keep out of the approach area.

b. Reduced Visibility.

It has always been recognized that precipitation reduces forward visibility. Consequently, although again it may be perfectly legal to cancel your IFR flight plan at any time you can proceed VFR, it is good practice, when preci tion is occurring, to continue IFR operation into a term area until you are reasonably close to your destination.

c. Simulated Instrument Flights.

In conducting simulated instrument flights, be sure t the weather is good enough to compensate for the restr ed visibility of the safety pilot and your greater concen tion on your flight instruments. Give yourself a little gr er margin when your flight plan lies in or near a b airway or close to an airport.

238. VFR HELICOPTER OPERATIONS AT CONTROLLED AIRPORTS

a. GENERAL

(1) The following ATC procedures and phraseolo recognize the unique capabilities of helicopters and w developed to improve service to all users. Helicopter de characteristics and user needs often require operati from movement and nonmovement areas within the a port boundary. In order for ATC to properly apply th procedures, it is essential that pilots familiarize themse with the local operations and make it known to controll when additional instructions are necessary.

(2) Insofar as possible, helicopter operations will be structed to avoid the flow of fixed-wing aircraft to m mize overall delays; however, there will be many situati where faster/larger helicopters may be integrated w fixed-wing aircraft for the benefit of all concerned. Ex ples would include IFR flights, avoidance of noise sensit areas, or use of runways/taxiways to minimize the haz ous effects of rotor downwash in congested areas.

(3) Because helicopter pilots are intimately famil with the effects of rotor downwash, they are best qualif to determine if a given operation can be conducted saf Accordingly, the pilot has the final authority with resp to the specific airspeed/altitude combinations. ATC cl ances are in no way intended to place the helicopter in hazardous position. It is expected that pilots will adv ATC if a specific clearance will cause undue hazards to p sons or property.

b. Controllers normally limit ATC ground service and struction to***movement*** areas; therefore, operations fro ***nonmovement*** areas are conducted at pilot discretion a should be based on local policies, procedures, or letters agreement. In order to maximize the flexibility of helic ter operations, it is necessary to rely heavily on sound pi judgment. For example, hazards such as debris, obstr tions, vehicles, or personnel must be recognized by t pilot, and action should be taken as necessary to avoid su hazards. Taxi, hover taxi, and air taxi operations are c sidered to be ground movements. Helicopters conducti such operations are expected to adhere to the same cond tions, requirements, and practices as apply to other grou taxiing and ATC procedures in the AIM.

(1) The phraseology***taxi*** is used when it is intended expected that the helicopter will taxi on the airport su face, either via taxiways or other prescribed routes. ***Tax*** used primarily for helicopters equipped with wheels or response to a pilot request. Preference should be given this procedure whenever it is necessary to minimize effe of rotor downwash.

(2) Pilots may request a***hover taxi*** when a slow for-
ard movement is desired, or when it may be appropriate
move very short distances. Pilots should avoid this pro-
dure if rotor downwash is likely to cause damage to
rked aircraft, or if blowing dust/snow could obscure visi-
lity. If it is necessary to operate above 25 feet AGL when
ver taxiing, the pilot should initiate a request to ATC.

(3)***Air taxi*** is the preferred method for helicopter
ound movements on airports provided ground operations
d conditions permit. Unless otherwise requested or in-
ructed, pilots are expected to remain below 100 feet AGL.
owever, if a higher than normal airspeed or altitude is
sired, the request should be made prior to lift-off. The
lot is solely responsible for selecting a safe airspeed for
e altitude/operation being conducted. Use o***air taxi*** en-
les the pilot to proceed at an optimum airspeed/altitude,
inimize downwash effect, conserve fuel, and expedite
ovement from one point to another. Helicopters should
oid overflight of other aircraft, vehicles, and personnel
ring air-taxi operations. Caution must be exercised con-
rning active runways and pilots must be certain that air
xi instructions are understood. Special precautions may
necessary at unfamiliar airports or airports with multi-
e/intersecting active runways. The taxi procedures in
ARA 241 thru PARA 243 also apply. (See Pilot/Controller
lossary - Taxi, Hover Taxi, Air Taxi definitions.)

c. Takeoff and Landing Procedures

(1) Helicopter operations may be conducted from a
nway, taxiway, portion of a landing strip, or any clear
ea which could be used as a landing site such as the
ene of an accident, a construction site, or the roof of a
ilding. The terms used to describe designated areas from
hich helicopters operate are: movement area, landing/
keoff area, apron/ramp, heliport and helipad (see Pilot/
ontroller Glossary). These areas may be improved or un-
nproved and may be separate from or located on an air-
ort/heliport. ATC will issue takeoff clearances from***move-***
ent areas other than active runways, or in diverse direc-
ons from active runways, with additional instructions as
ecessary. Whenever possible, takeoff clearance will be
sued in lieu of extended hover/air taxi operations. Phra-
ology will be "CLEARED FOR TAKEOFF FROM (taxi-
ay, helipad, runway number, etc.) MAKE RIGHT/LEFT
URN FOR (direction, heading, NAVAID radial) DEPAR-
URE/DEPARTURE ROUTE (number, name, etc.)."
nless requested by the pilot, downwind takeoffs will not
issued if the tailwind exceeds 5 knots.

(2) Pilots should be alert to wind information as well
to wind indications in the vicinity of the helicopter. ATC
hould be advised of the intended method of departing. A
lot request to takeoff in a given direction indicates that
e pilot is willing to accept the wind condition and con-
ollers will honor the request if traffic permits. Departure
oints could be a significant distance from the control
wer and it may be difficult or impossible for the control-
r to determine the helicopter's relative position to the
ind.

(3) If takeoff is requested from***nonmovement*** areas,
e phraseology "PROCEED AS REQUESTED" will be
ed. Additional instructions will be issued as necessary.
he pilot is responsible for operating in a safe manner and
hould exercise due caution. When other known traffic is
ot a factor and takeoff is requested from an area not visi-
le from the tower, an area not authorized for helicopter
use, an unlighted area at night, or an area not on the airport, the phraseology "DEPARTURE FROM (location) WILL BE AT YOUR OWN RISK (with reason, and additional instructions as necessary)."

(4) Similar phraseology is used for helicopter landing operations. Every effort will be made to permit helicopters to proceed direct and land as near as possible to their final destination on the airport. Traffic density, the need for detailed taxiing instructions, frequency congestion, or other factors may affect the extent to which service can be expedited. As with ground movement operations, a high degree of pilot/controller cooperation and communication is necessary to achieve safe and efficient operations.

239—240. RESERVED

241. TAXIING

a. General: Approval must be obtained prior to moving an aircraft or vehicle onto the movement area during the hours an airport traffic control tower is in operation.

(1) Always state your position on the airport when calling the tower for taxi instructions.

(2) The movement area is normally described in local bulletins issued by the airport manager or control tower. These bulletins may be found in FSSs, fixed base operators offices, air carrier offices and operations offices.

(3) The control tower also issues bulletins describing areas where they cannot provide ATC service due to nonvisibility or other reasons.

(4) A clearance must be obtained prior to taxiing on a runway, taking off, or landing during the hours an airport traffic control tower is in operation.

(5) When ATC clears an aircraft to "taxi to" an assigned takeoff runway, the absence of holding instructions authorizes the aircraft to "cross" all runways which the taxi route intersects except the assigned takeoff runway. It does not include authorization to "taxi onto" or "cross" the assigned takeoff runway at any point. In order to preclude misunderstandings in radio communications, ATC will not use the word "cleared" in conjunction with authorization for aircraft to taxi.

(6) In the absence of holding instructions, a clearance to "taxi to" any point other than an assigned takeoff runway is a clearance to cross all runways that intersect the taxi route to that point.

(7) When ATC authorizes an aircraft to taxi to an assigned departure runway and hold short instructions will be issued, they will first specify the runway, issue taxi instructions, and then state the hold short instructions. This does not authorize the aircraft to "enter" or "cross" the assigned departure runway at any point.

b. ATC clearances or instructions pertaining to taxiing are predicated on known traffic and known physical airport conditions. Therefore, it is important that pilots clearly understand the clearance or instruction. Although an ATC clearance is issued for taxiing purposes, when operating in accordance with the FARs, it is the responsibility of the pilot to avoid collision with other aircraft. Since "the pilot in command of an aircraft is directly responsible for, and is the final authority as to, the operation of that air-

craft" the pilot should obtain clarification of any clearance or instruction which is not understood. (See PARA—540.)

c. At those airports where the U.S. Government operates the control tower and ATC has authorized noncompliance with the requirement for two-way radio communications while operating within the airport traffic area, or at those airports where the U.S. Government does not operate the control tower and radio communications cannot be established, pilots shall obtain a clearance by visual light signal prior to taxiing on a runway and prior to takeoff and landing.

d. The following phraseologies and procedures are used in radio-telephone communications with aeronautical ground stations.

(1) Request for taxi instructions prior to departure: State your aircraft identification, location, type of operation planned (VFR or IFR) and the point of first intended landing.

EXAMPLE:

Aircraft: "WASHINGTON GROUND, BEECHCRAFT ONE THREE ONE FIVE NINER AT HANGAR EIGHT, READY TO TAXI, IFR TO CHICAGO."

Tower: "BEECHCRAFT ONE THREE ONE FIVE NINER, TAXI TO RUNWAY THREE SIX, WIND ZERO THREE ZERO AT TWO FIVE, ALTIMETER THREE ZERO ZERO FOUR."

Tower: "BEECHCRAFT ONE THREE ONE FIVE NINER, RUNWAY TWO SEVEN, TAXI VIA TAXIWAYS CHARLIE AND DELTA, HOLD SHORT OF RUNWAY THREE THREE LEFT."

(2) Receipt of ATC clearance: ARTCC clearances are relayed to pilots by airport traffic controllers in the following manner:

EXAMPLE:

Tower: BEECHCRAFT ONE THREE ONE FIVE NINER CLEARED TO THE CHICAGO MIDWAY AIRPORT, VIA VICTOR EIGHT, MAINTAIN EIGHT THOUSAND.

Aircraft: "BEECHCRAFT ONE THREE ONE FIVE NINER CLEARED TO THE CHICAGO MIDWAY AIRPORT, VIA VICTOR EIGHT, MAINTAIN EIGHT THOUSAND."

NOTE.— Normally, an ATC IFR clearance is relayed to a pilot by the ground controller. At busy locations, however, pilots may be instructed by the ground controller to "CONTACT CLEARANCE DELIVERY" on a frequency designated for this purpose. No surveillance or control over the movement of traffic is exercised by this position of operation.

(3) Request for taxi instructions after landing: State your aircraft identification, location, and that you request taxi instructions.

EXAMPLE:

Aircraft: "DULLES GROUND BEECHCRAFT ONE FOUR TWO SIX ONE CLEARING RUNWAY ONE RIGHT ON TAXIWAY E3, REQUEST CLEARANCE TO PAGE."

Tower: "BEECHCRAFT ONE FOUR TWO SIX ONE, TAXI TO PAGE VIA TAXIWAYS E3, E1 and E9."

242. TAXI DURING LOW VISIBILITY

a. Pilots and aircraft operators should be consta aware that during certain low visibility conditio movement of aircraft and vehicles on airports may visible to the tower controller. This may prevent confirmation of an aircraft's adherence to taxi instruct Pilots should, therefore, exercise extreme vigilance proceed cautiously under such conditions.

b. Of vital importance is the need for pilots to the controller when difficulties are encountered or a first indication of becoming disoriented. Pilots should ceed with extreme caution when taxiing toward the When vision difficulties are encountered pilots should mediately inform the controller.

243. EXITING THE RUNWAY AFTER LANDING

After landing, unless otherwise instructed by the co tower, continue to taxi in the landing direction, proce the nearest suitable taxiway and exit the runway wit delay. Do not turn on to another runway or make a degree turn to taxi back on an active runway or chang ground control frequency while on the active runway out authorization from the tower.

244. PRACTICE INSTRUMENT APPROACHES

a. Various air traffic incidents have indicated the cessity for adoption of measures to achieve more orga and controlled operations where practice instrumen proaches are conducted. Practice instrument appro are considered to be instrument approaches made by ei a VFR aircraft not on an IFR flight plan or an aircraft an IFR flight plan. To achieve this and thereby enh air safety, it is Air Traffic Operations Service policy to p vide for separation of such operations at locations wh approach control facilities are located and, as resour permit, at certain other locations served by ARTCCs parent approach control facilities. Pilot requests to prac instrument approaches may be approved by ATC subject traffic and workload conditions. Pilots should anticip that in some instances the controller may find it neces to deny approval or withdraw previous approval when t fic conditions warrant. It must be clearly understood, h ever, that even though the controller may be providing aration, pilots on VFR flight plans are required to com with basic visual flight rules (FAR—91.105). Applicatio ATC procedures or any action taken by the controller avoid traffic conflictions does not relieve IFR and V pilots of their responsibility to see and avoid other tra while operating in VFR conditions. (FAR—91.67) In a tion to the normal IFR separation minimums (which cludes visual separation) during VFR conditions, 500 f vertical separation may be applied between VFR airc and between a VFR aircraft and the IFR aircraft. Pil not on IFR flight plans desiring practice instrument proaches should always state 'practice' when making quests to ATC. Controllers will instruct VFR aircraft questing an instrument approach to maintain VFR. This to preclude misunderstandings between the pilot and c troller as to the status of the aircraft. If the pilot wishes proceed in accordance with instrument flight rules, he must specifically request and obtain, an IFR clearance.

b. Before practicing an instrument approach, pilots should inform the approach control facility or the tower of the type of practice approach they desire to make and how they intend to terminate it, i.e., full-stop landing, touch-and-go, or missed or low approach maneuver. This information may be furnished progressively when conducting a series of approaches. Pilots on an IFR flight plan, who have made a series of instrument approaches to full stop landings should inform ATC when they make their final landing. The controller will control flights practicing instrument approaches so as to ensure that they do not disrupt the flow of arriving and departing itinerant IFR or VFR aircraft. The priority afforded itinerant aircraft over practice instrument approaches is not intended to be so rigidly applied that it causes grossly inefficient application of services. A minimum delay to itinerant traffic may be appropriate to allow an aircraft practicing an approach to complete that approach.

c. At airports without a tower, pilots wishing to make practice instrument approaches should notify the facility having control jurisdiction of the desired approach as indicated on the approach chart. All approach control facilities and ARTCCs are required to publish aLetter to Airmen depicting those airports where they provide standard separation to both VFR and IFR aircraft conducting practice instrument approaches.

d. The Controller will provide approved separation between both VFR and IFR aircraft when authorization is granted to make practice approaches to airports where an approach control facility is located and to certain other airports served by approach control or an ARTCC. Controller responsibility for separation of VFR aircraft begins at the point where the approach clearance becomes effective, or when the aircraft enters TRSA/TCA airspace, whichever comes first.

e. VFR aircraft practicing instrument approaches are not automatically authorized to execute the missed approach procedure. This authorization must be specifically requested by the pilot and approved by the controller. Separation will not be provided unless the missed approach has been approved by ATC.

f. Except in an emergency, aircraft cleared to practice instrument approaches must not deviate from the approved procedure until cleared to do so by the controller.

g. At radar approach control locations when a full approach procedure (procedure turn, etc.) cannot be approved, pilots should expect to be vectored to a final approach course for a practice instrument approach which is compatible with the general direction of traffic at that airport.

h. When granting approval for a practice instrument approach, the controller will usually ask the pilot to report to the tower prior to or over the final approach fix inbound (non precision approaches) or over the outer marker or fix used in lieu of the outer marker inbound (precision approaches).

i. When authorization is granted to conduct practice instrument approaches to an airport with a tower, but where approved standard separation is not provided to aircraft conducting practice instrument approaches, the tower will approve the practice approach, instruct the aircraft to maintain VFR and issue traffic information, as required.

j. When an aircraft notifies a FSS providing Airport Advisory Service to the airport concerned of the intent to conduct a practice instrument approach and whether or not separation is to be provided, the pilot will be instructed to contact the appropriate facility on a specified frequency prior to initiating the approach. At airports where separation is not provided, the FSS will acknowledge the message and issue known traffic information but will neither approve or disapprove the approach.

k. Pilots conducting practice instrument approaches should be particularly alert for other aircraft operating in the local traffic pattern or in proximity to the airport.

245. OPTION APPROACH

The "Cleared for the Option" procedure will permit an instructor, flight examiner or pilot the option to make a touch-and-go, low approach, missed approach, stop-and-go, or full stop landing. This procedure can be very beneficial in a training situation in that neither the student pilot nor examinee would know what maneuver would be accomplished. The pilot should make his request for this procedure passing the final approach fix inbound on an instrument approach or entering downwind for a VFR traffic pattern. The advantages of this procedure as a training aid are that it enables an instructor or examiner to obtain the reaction of a trainee or examinee under changing conditions, the pilot would not have to discontinue an approach in the middle of the procedure due to student error or pilot proficiency requirements, and finally it allows more flexibility and economy in training programs. This procedure will only be used at those locations with an operational control tower and will be subject to ATC approval.

246. USE OF AIRCRAFT LIGHTS

a. Aircraft position and anticollision lights are required to be lighted on aircraft operated from sunset to sunrise. Anticollision lights, however, need not be lighted when the pilot in command determines that, because of operating conditions, it would be in the interest of safety to turn off the lights (FAR—91.73). For example, strobe lights should be turned off on the ground when they adversely affect ground personnel or other pilots, and in flight when there are adverse reflection from clouds.

b. An aircraft anticollision light system can use one or more rotating beacons and/or strobe lights, be colored either red or white, and have different (higher than minimum) intensities when compared to other aircraft. Many aircraft have both a rotating beacon and a strobe light system.

c. The FAA has a voluntary pilot safety program,*Operation Lights On*, to enhance the*see-and-avoid* concept. Pilots are encouraged to turn on their anticollision lights any time the engine(s) are running, day or night. Pilots are also encouraged to turn on their landing lights during takeoff; i.e., either after takeoff clearance has been received or when beginning takeoff roll. Pilots are further encouraged to turn on their landing lights when operating below 10,000 feet, day or night, especially when operating within 10 miles of any airport, or in conditions of reduced visibility and in areas where flocks of birds may be expected, i.e., coastal areas, lake areas, around refuse dumps, etc. Although turning on aircraft lights does enhance the *see-and-avoid* concept, pilots should not become complacent about keeping a sharp lookout for other aircraft. Not all aircraft are equipped with lights and some pilots may not have their lights turned on. Aircraft manufacturer's recommendations for operation of landing lights and electrical systems should be observed.

d. Prop and jet blast forces generated by large aircraft have overturned or damaged several smaller aircraft taxiing behind them. To avoid similar results, and in the interest of preventing upsets and injuries to ground personnel from such forces, the FAA recommends that air carriers and commercial operators turn on their rotating beacons anytime their aircraft engines are in operation. General aviation pilots using rotating beacon equipped aircraft are also encouraged to participate in this program which is designed to alert others to the potential hazard. Since this is a voluntary program, exercise caution and do not rely solely on the rotating beacon as an indication that aircraft engines are in operation.

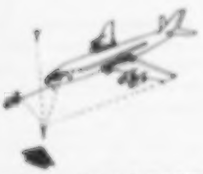
247. FLIGHT INSPECTION/'FLIGHT CHECK' AIRCRAFT IN TERMINAL AREAS

a. *Flight check* is a call sign used to alert pilots an traffic controllers when a FAA aircraft is engaged in fl inspection/certification of NAVAIDs and flight procedu Flight Check aircraft fly preplanned high/low altit flight patterns such as grids, orbits, DME arcs, and tra including low passes along the full length of the runway verify NAVAID performance. In most instances, the flight checks are being automatically recorded and flown in an automated mode.

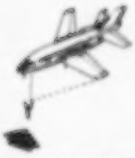
b. Pilots should be especially watchful and avoid flight paths of any aircraft using the call sign "Flig Check" or "Flight Check recorded." The latter call e.g. "Flight Check 47 recorded" indicates that autom flight inspections are in progress in terminal areas. Th flights will normally receive special handling from AT Pilot patience and cooperation in allowing uninterrup recordings can significantly help expedite flight insp tions, minimize costly, repetitive runs, and reduce burden on the U.S. taxpayer.

248—258 RESERVED.

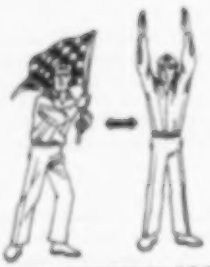
259. HAND SIGNALS



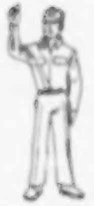
SIGNALMAN DIRECTS TOWING



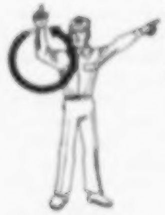
SIGNALMAN'S POSITION



FLAGMAN DIRECTS PILOT TO SIGNALMAN IF TRAFFIC CONDITIONS REQUIRE

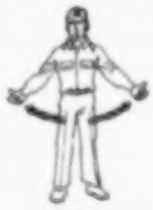


ALL CLEAR (O.K.)

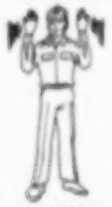


POINT TO ENGINE TO BE STARTED

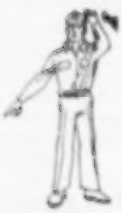
START ENGINE



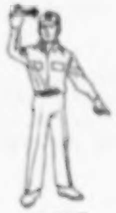
PULL CHOCKS



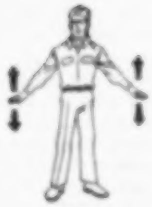
COME AHEAD



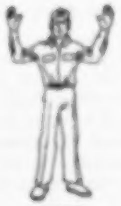
LEFT TURN



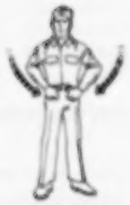
RIGHT TURN



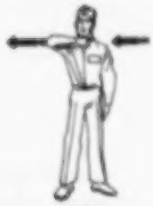
SLOW DOWN



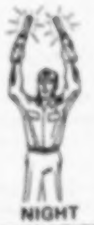
STOP



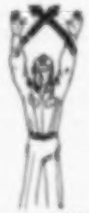
INSERT CHOCKS



CUT ENGINES



NIGHT OPERATION (Uses same hand movements as day operation)



EMERGENCY STOP

NOTES

Section 4. ATC CLEARANCES/SEPARATIONS

260. CLEARANCE

a. A clearance issued by ATC is predicated on known traffic and known physical airport conditions. An ATC clearance means an authorization by ATC, for the purpose of preventing collision between known aircraft, for an aircraft to proceed under specified conditions within controlled airspace. IT IS NOT AUTHORIZATION FOR A PILOT TO DEVIATE FROM ANY RULE REGULATION OR MINIMUM ALTITUDE NOR TO CONDUCT UNSAFE OPERATION OF HIS AIRCRAFT.

b. FAR—91.3(a) states: "The pilot in command of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft." If ATC issues a clearance that would cause a pilot to deviate from a rule or regulation, or in the pilot's opinion, would place the aircraft in jeopardy, IT IS THE PILOT'S RESPONSIBILITY TO REQUEST AN AMENDED CLEARANCE. Similarly, if a pilot prefers to follow a different course of action, such as make a 360 degree turn for spacing to follow traffic when established in a landing or approach sequence, land on a different runway, takeoff from a different intersection, takeoff from the threshold instead of an intersection or delay his operation, HE IS EXPECTED TO INFORM ATC ACCORDINGLY. When he requests a different course of action, however, the pilot is expected to cooperate so as to preclude disruption of traffic flow or creation of conflicting patterns. The pilot is also expected to use the appropriate aircraft call sign to acknowledge all ATC clearances, frequency changes, or advisory information.

c. When weather conditions permit, during the time an IFR flight is operating, it is the direct responsibility of the pilot to avoid other aircraft since VFR flights may be operating in the same area without the knowledge of ATC. Traffic clearances provide standard separation only between IFR flights.

261. CLEARANCE PREFIX

A clearance, control information, or a response to a request for information originated by an ATC facility and relayed to the pilot through an air to ground communication station will be prefixed by "ATC CLEARS," "ATC ADVISES," or "ATC REQUESTS."

262. CLEARANCE ITEMS

ATC clearances normally contain the following:

a. Clearance Limit. — The traffic clearance issued prior to departure will normally authorize flight to the airport of intended landing. Under certain conditions, at some locations a short-range clearance procedure is utilized whereby a clearance is issued to a fix within or just outside of the terminal area and the pilot is advised of the frequency on which he will receive the long-range clearance direct from the center controller.

b. Departure Procedure. — Headings to fly and altitude restrictions may be issued to separate a departure from other air traffic in the terminal area. (See PARA—322 - ABBREVIATED IFR DEPARTURE CLEARANCE PROCEDURES and PARA—325 - INSTRUMENT DEPARTURES.) Where the volume of traffic warrants, SIDs have been developed.

c. Route of Flight.

(1) Clearances are normally issued for the altitude or flight level and route filed by the pilot. However, due to traffic conditions, it is frequently necessary for ATC to specify an altitude or flight level or route different from that requested by the pilot. In addition, flow patterns have been established in certain congested areas, or between congested areas, whereby traffic capacity is increased by routing all traffic on preferred routes. Information on these flow patterns is available in offices where preflight briefing is furnished or where flight plans are accepted.

(2) When required, air traffic clearances include data to assist pilots in identifying radio reporting points. It is the responsibility of the pilot to notify ATC immediately if his radio equipment cannot receive the type of signals he must utilize to comply with his clearance.

d. Altitude Data.

(1) The altitude or flight level instructions in an ATC clearance normally require that a pilot "MAINTAIN" the altitude or flight level at which the flight will operate when in controlled airspace. Altitude or flight level changes while en route should be requested prior to the time the change is desired.

(2) When possible, if the altitude assigned is different from the altitude requested by the pilot, ATC will inform the pilot when to expect climb or descent clearance or to request altitude change from another facility. If this has not been received prior to crossing the boundary of the ATC facility's area and assignment at a different altitude is still desired, the pilot should reinitiate his request with the next facility.

(3) The term "CRUISE" may be used instead of "MAINTAIN" to assign a block of airspace, to a pilot, from the minimum IFR altitude up to and including the altitude specified in the cruise clearance. The pilot may level off at any intermediate altitude within this block of airspace. Climb/descent within the block is to be made at the discretion of the pilot. However, once the pilot starts descent and verbally reports leaving an altitude in the block, he may not return to that altitude without additional ATC clearance.

NOTE.— See definition of CRUISE in the PILOT CONTROLLER GLOSSARY.

e. Holding Instructions.

(1) Whenever an aircraft has been cleared to a fix other than the destination airport and delay is expected, it is the responsibility of the ATC controller to issue complete holding instructions (unless the pattern is charted), an EFC time, and his best estimate of any additional en route/terminal delay.

(2) If the holding pattern is charted and the controller doesn't issue complete holding instructions, the pilot is expected to hold as depicted on the appropriate chart. When the pattern is charted, the controller may omit all holding instructions except the charted holding direction and the statement*AS PUBLISHED*, e.g.,"*HOLD EAST AS PUBLISHED.*" Controllers shall always issue complete holding instructions when pilots request them.

NOTE.— Only those holding patterns depicted on U.S. Government or commercially produced (meeting FAA requirements) *Low/High Altitude En route, and Area or Star charts* should be used.

(3) If no holding pattern is charted and holding instructions have not been issued, the pilot should ask ATC for holding instructions prior to reaching the fix. This procedure will eliminate the possibility of an aircraft entering a holding pattern other than that desired by ATC. If the pilot is unable to obtain holding instructions prior to reaching the fix (due to frequency congestion, stuck microphone, etc.), he should hold in a standard pattern on the course on which he approached the fix and request further clearance as soon as possible. In this event, the altitude/flight level of the aircraft at the clearance limit will be protected so that separation will be provided as required.

(4) When an aircraft is 3 minutes or less from a clearance limit and a clearance beyond the fix has not been received, the pilot is expected to start a speed reduction so that he will cross the fix, initially, at or below the maximum holding airspeed.

(5) When no delay is expected, the controller should issue a clearance beyond the fix as soon as possible and, whenever possible, at least 5 minutes before the aircraft reaches the clearance limit.

(6) Pilots should report to ATC the time and altitude/flight level at which the aircraft reaches the clearance limit and report leaving the clearance limit.

NOTE.— In the event of two-way communications failure, pilots are required to comply with FAR 91.127.

263. AMENDED CLEARANCES

a. Amendments to the initial clearance will be issued at any time an air traffic controller deems such action necessary to avoid possible confliction between aircraft. Clearances will require that a flight "hold" or change altitude prior to reaching the point where standard separation from other IFR traffic would no longer exist.

NOTE.— Some pilots have questioned this action and requested "traffic information" and were at a loss when the reply indicated "no traffic report." In such cases the controller has taken action to prevent a traffic confliction which would have occurred at a distant point.

b. A pilot may wish an explanation of the handling of his flight at the time of occurrence; however, controllers are not able to take time from their immediate control duties nor can they afford to overload the ATC communications channels to furnish explanations. Pilots may obtain an explanation by directing a letter or telephone call to the chief controller of the facility involved.

c. The pilot has the privilege of requesting a different clearance from that which has been issued by ATC if he feels that he has information which would make another course of action more practicable or if aircraft equipment limitations or company procedures forbid compliance with the clearance issued.

264. SPECIAL VFR CLEARANCES

a. An ATC clearance must be obtained *prior* to operating within a control zone when the weather is less than that required for VFR flight. A VFR pilot may request and be given a clearance to enter, leave or operate within most control zones in special VFR conditions, traffic permitting and providing such flight will not delay IFR operations. All special VFR flights must remain clear of clouds. The visibility requirements for Special VFR fixed-wing aircraft are:

(1) One mile flight visibility for operations within the control zone.

(2) One mile ground visibility if taking off or landing.

b. When a control tower is located within the control zone, requests for clearances should be to the tower. If no tower is located within the control zone, a clearance may be obtained from the nearest tower, FSS or center.

c. It is not necessary to file a complete flight plan with the request for clearance but the pilot should state his intentions in sufficient detail to permit ATC to fit his flight into the traffic flow. The clearance will not contain a specific altitude as the pilot must remain clear of clouds. The controller may require the pilot to fly at or below a certain altitude due to other traffic, but the altitude specified will permit flight at or above the minimum safe altitude. In addition, at radar locations, flights may be vectored if necessary for control purposes or on pilot request.

NOTE. The pilot is responsible for obstacle or terrain clearance (reference FAR—91.79).

d. Special VFR clearances are effective within control zones only. ATC does not provide separation after an aircraft leaves the control zone on a special VFR clearance.

e. Special VFR operations by fixed-wing aircraft are prohibited in some control zones due to the volume of IFR traffic. A list of these control zones is contained in FAR-93.113. They are also depicted on Sectional Aeronautical Charts.

f. ATC provides separation between special VFR flights and between these flights and other IFR flights.

g. Special VFR operations by fixed-wing aircraft are prohibited between sunset and sunrise unless the pilot is instrument rated and the aircraft is equipped for IFR flight.

265. PILOT RESPONSIBILITY UPON CLEARANCE ISSUANCE

a. RECORD ATC CLEARANCE — When conducting an IFR operation, make a written record of your clearance. The specified conditions which are a part of your air traffic clearance may be somewhat different from those included in your flight plan. Additionally, ATC may find it necessary to ADD conditions, such as particular departure route. The very fact that ATC specifies different or additional conditions means that other aircraft are involved in the traffic situation.

b. ATC CLEARANCE/INSTRUCTION READBACK — Pilots of airborne aircraft should read back *those parts* of ATC clearances and instructions containing altitude assignments or vectors, as a means of mutual verification. The readback of the "numbers" serves as a double check between pilots and controllers and reduces the kinds of communications errors that occur when a number is either "misheard" or is incorrect.

(1) Precede all readbacks and acknowledgements with the aircraft identification. This aids controllers in determining that the correct aircraft received the clearance or instruction. The requirement to include aircraft identification in all readbacks and acknowledgements becomes more important as frequency congestion increases and when aircraft with similar call signs are on the same frequency.

(2) Read back altitudes, altitude restrictions, and vectors in the same sequence as they are given in the clearance or instruction.

(3) Altitudes contained in charted procedures such as SIDs, instrument approaches, etc., should not be read back unless they are specifically stated by the controller.

c. It is the responsibility of the pilot to accept or refuse the clearance issued.

266. IFR CLEARANCE VFR-ON-TOP

a. A pilot on an IFR flight plan operating in VFR weather conditions, may request VFR ON TOP in lieu of an assigned altitude. This would permit the pilot to select an altitude or flight level of his choice (subject to any ATC restrictions.)

b. Pilots desiring to climb through a cloud, haze, smoke, or other meteorological formation and then either cancel their IFR flight plan or operate VFR ON TOP may request a climb to VFR ON TOP. The ATC authorization shall contain either a top report or a statement that no top report is available, and a request to report reaching VFR ON TOP. Additionally, the ATC authorization may contain a clearance limit, routing and an alternative clearance if VFR ON TOP is not reached by a specified altitude.

c. A pilot on an IFR flight plan, operating in VFR conditions, may request to climb/descend in VFR conditions.

d. ATC may not authorize VFR ON TOP/VFR CONDITIONS operations unless the pilot requests the VFR operation or a clearance to operate in VFR CONDITIONS will result in noise abatement benefits where part of the IFR departure route does not conform to an FAA approved noise abatement route or altitude.

e. When operating in VFR conditions with an ATC authorization to "MAINTAIN VFR ON TOP/MAINTAIN VFR CONDITIONS" pilots on IFR flight plans must:

(1) Fly at the appropriate VFR altitude as prescribed in FAR—91.109.

(2) Comply with the VFR visibility and distance from cloud criteria in FAR—91.105 (BASIC VFR WEATHER MINIMUMS.)

(3) Comply with instrument flight rules that are applicable to this flight (i.e., *minimum IFR altitudes*, position reporting, radio communications, course to be flown, adherence to ATC clearance, etc.).

NOTE.— Pilots should advise ATC prior to any altitude change to insure the exchange of accurate traffic information.

f. ATC authorization to "MAINTAIN VFR ON TOP" is not intended to restrict pilots so that they must operate only *above* an obscuring meteorological formation (layer). Instead, it permits operation above, below, between layers or in areas where there is no meteorological obscuration. It is imperative, however, that pilots understand that clearance to operate "VFR ON TOP/VFR CONDITIONS" does not imply cancellation of the IFR flight plan.

g. Pilots operating VFR ON TOP/VFR CONDITIONS, may receive traffic information, from ATC, on other pertinent IFR or VFR aircraft. However, aircraft operating in TCAs/TRSAs shall be separated as required by FAA Handbook 7110.65.

NOTE.— When operating in VFR weather conditions, it is the pilot's responsibility to be vigilant so as to see and avoid other aircraft.

h. ATC will not authorize VFR or VFR ON TOP operations in PCAs. (See PARA—93 - POSITIVE CONTROL AREA.)

267—269. RESERVED

270. ADHERENCE TO CLEARANCE

a. When air traffic clearance has been obtained under either Visual or Instrument Flight Rules, the pilot in command of the aircraft shall not deviate from the provisions thereof unless an amended clearance is obtained. When ATC issues a clearance or instruction pilots are expected to execute its provisions upon receipt. ATC, in certain situations, will include the word "IMMEDIATELY" in a clearance or instruction to immpress urgency of an imminent situation and expeditious compliance by the pilot is expected and necessary for safety. The addition of a VFR or other restriction (i.e., climb or descent point or time, crossing altitude, etc.) does not authorize a pilot to deviate from the route of flight or any other provision of the ATC clearance.

b. When a heading is assigned or a turn is requested by ATC, pilots are expected to promptly initiate the turn, to complete the turn, and maintain the new heading unless issued additional instructions.

c. The term "at pilot's discretion" included in the altitude information of an ATC clearance means that ATC has offered the pilot the option to start climb or descent when he wishes. He is authorized to conduct the climb or descent at any rate he wishes, and to temporarily level off at any intermediate altitude he may desire. However, once he has vacated an altitude, he may not return to that altitude.

d. When ATC has not used the term "AT PILOT'S DISCRETION" nor imposed any climb or descent restrictions, pilots should initiate climb or descent promptly on acknowledgement of the clearance. Descend or climb at an optimum rate consistent with the operating characteristics of the aircraft to 1,000 feet above or below the assigned altitude, and then attempt to descend or climb at a rate of 500 feet per minute until the assigned altitude is reached. If at anytime the pilot is unable to climb or descend at a rate of at least 500 feet a minute, advise ATC. If it is necessary to level off at an intermediate altitude during climb or descent, advise ATC, except for level off at 10,000 feet MSL on descent or 3,000 feet above airport elevation (prior to entering an airport traffic area), when required for speed reduction (FAR—91.70).

NOTE.— Leveling off at 10,000 feet MSL on descent, or 3,000 feet above airport elevation (prior to entering in an airport traffic area), to comply with FAR—91.70 airspeed restrictions, is commonplace. Controllers anticipate this action and plan accordingly. Leveling off at any other time, on climb or descent, may seriously affect air traffic handling by ATC. Consequently, it is imperative that pilots make every effort to fulfill the above expected actions to aid ATC in safely handling and expediting traffic.

e. If the altitude information of an ATC DESCENT clearance includes a provision to "CROSS (fix) AT or AT OR ABOVE/BELOW (altitude)," "the manner in which the descent is executed to comply with the crossing altitude is at the pilot's discretion." This authorization to descend at pilot's discretion is only applicable to that portion of the flight to which the crossing altitude restriction applies, and the pilot is expected to comply with the crossing altitude as a provision of the clearance. Any other clearance in which pilot execution is optional will so state: "AT PILOT'S DISCRETION."

EXAMPLE:

"UNITED FOUR SEVENTEEN, DESCEND AND MAINTAIN SIX THOUSAND."

NOTE.— The pilot is expected to commence descent upon receipt of the clearance, and to descend at the suggested rates until reaching the assigned altitude of 6,000 feet.

EXAMPLE:

"UNITED FOUR SEVENTEEN, DESCEND AT PILOT'S DISCRETION, MAINTAIN SIX THOUSAND."

NOTE.— The pilot is authorized to conduct descent within the context of the term AT PILOT'S DISCRETION as described above.

EXAMPLE:

"UNITED FOUR SEVENTEEN, CROSS LAKEVIEW VOR AT OR ABOVE FLIGHT LEVEL TWO ZERO ZERO, DESCEND AND MAINTAIN SIX THOUSAND."

NOTE.— The pilot is authorized to conduct descent AT PILOT'S DISCRETION until reaching Lakeview VOR. He must comply with the clearance provision to cross the Lakeview VOR at or above FL 200. After passing Lakeview VOR, he is expected to descend at the suggested rates until reaching the assigned altitude of 6,000 feet.

EXAMPLE:

"UNITED FOUR SEVENTEEN, CROSS LAKEVIEW VOR AT SIX THOUSAND, MAINTAIN SIX THOUSAND."

NOTE.— The pilot is authorized to conduct descent AT PILOT'S DISCRETION, however, he must comply with the clearance provision to cross the Lakeview VOR at 6,000 feet.

EXAMPLE:

"UNITED FOUR SEVENTEEN, DESCEND NOW TO FLIGHT LEVEL TWO SEVEN ZERO, CROSS LAKEVIEW VOR AT OR BELOW ONE ZERO THOUSAND, DESCEND AND MAINTAIN SIX THOUSAND."

NOTE.— The pilot is expected to promptly execute and complete descent to FL 270 upon receipt of the clearance. After reaching FL 270 he is authorized to descend "at pilot's discretion" until reaching Lakeview VOR. He must comply with the clearance provision to cross Lakeview VOR at or below 10,000 feet. After Lakeview VOR he is expected to descend at the suggested rates until rea ing 6,000 feet.

f. In case emergency authority is used to deviate fr provisions of an ATC clearance, the pilot in command th notify ATC as soon as possible and obtain an amend clearance. In an emergency situation which does not res in a deviation from the rules prescribed in FAR—91 b which requires ATC to give priority to an aircraft, the pi of such aircraft shall, when requested by ATC, make report within 48 hours of such emergency situation to t chief of that ATC facility.

g. The guiding principle is that the last ATC clear has precedence over the previous ATC clearance. When t route or altitude in a previously issued clearance is ame ed, the controller will restate applicable altitude restr tions. If altitude to maintain is changed or restated, whe er prior to departure or while airborne, and previou issued altitude restrictions are omitted, those altitude strictions are canceled, including SID altitude restrictio

EXAMPLE:

A departure flight receives a clearance to destinat airport to maintain FL 290. The clearance incorpora a SID which has certain altitude crossing restriction Shortly after takeoff, the flight receives a new cle ance changing the maintaining FL from 290 to 250. the altitude restrictions are still applicable, the co troller restates them.

EXAMPLE:

A departing aircraft is cleared to cross Fluky inters tion at or above 3,000 feet, Gordonville VOR at above 12,000 feet, maintain FL 200. Shortly after d parture, the altitude to be maintained is changed FL 240. If the altitude restrictions are still applicab the controller issues an amended clearance as follow "CROSS FLUKY INTERSECTION AT OR ABOV THREE THOUSAND, CROSS GORDONVILLE VO AT OR ABOVE ONE TWO THOUSAND, MAINTAI FLIGHT LEVEL TWO FOUR ZERO.":

EXAMPLE:

An arriving aircraft is cleared to his destination ai port via V45 Delta VOR direct, he is cleared to cro Delta VOR at 10,000 feet and then to, maintain 6,00 feet. Prior to Delta VOR, the controller issues amen ed clearance as follows: "TURN RIGHT HEADIN ONE EIGHT ZERO FOR VECTOR TO RUNWA THREE SIX ILS APPROACH, MAINTAIN 6,000."

NOTE.— Because the altitude restriction "cross Delta VOR 10,000 feet" was omitted from the amended clearance, it is longer in effect.

h. Pilots of turbojet aircraft equipped with afterburn engines should advise ATC prior to takeoff if they intend use afterburning during their climb to the en route al tude. Often, the controller may be able to plan his traffic accommodate a high performance climb and allow the pil to climb to his planned altitude without restriction.

271. IFR SEPARATION STANDARDS

a. ATC effects separation of aircraft vertically by signing different altitudes; longitudinally by providing interval expressed in time or distance between aircraft the same, converging, or crossing courses, and laterally by assigning different flight paths.

b. Separation will be provided between all aircraft operating on IFR flight plans except during that part of the flight (outside of a TCA or TRSA) being conducted on a VFR ON TOP/ VFR CONDITIONS clearance. Under these conditions, ATC may issue traffic advisories but it is the sole responsibility of the pilot to be vigilant so as to see and avoid other aircraft.

c. When radar is employed in the separation of aircraft at the same altitude, a minimum of 3 miles separation is provided between aircraft operating within 40 miles of the radar antenna site, and 5 miles between aircraft operating beyond 40 miles from the antenna site. These minima may be increased or decreased in certain specific situations.

272. SPEED ADJUSTMENTS

a. To avoid excessive vectoring, ATC may request pilots of radar controlled aircraft to adjust speed.

b. ATC will express all speed adjustments in terms of knots based on indicated airspeed (IAS) in 10 knot increments except that at or above FL 240 speeds may be expressed in terms of mach numbers in .01 increments. The use of mach numbers is restricted to turbojet aircraft with mach meters.

c. Pilots complying with speed adjustments are expected to maintain a speed within plus or minus 10 knots or .02 mach number of the specified speed.

d. Unless pilot concurrence is obtained, ATC requests for speed adjustments will be in accordance with the following minimums:

(1) To aircraft operating between FL 280 and 10,000 feet, a speed not less than 250 knots or the equivalent mach number.

(2) To turbine powered aircraft operating below 10,000 feet:

(a) A speed not less than 210 knots, except;

(b) Within 20 flying miles of the airport of intended landing, a speed not less than 170 knots.

(3) Reciprocating engine or turboprop aircraft within 20 flying miles of the runway threshold of the airport of intended landing, a speed not less than 150 knots.

(4) To departing aircraft:

(a) Turbine powered aircraft, a speed not less than 230 knots.

(b) Reciprocating engine aircraft, a speed not less than 150 knots.

e. When ATC combines a speed adjustment with a descent clearance, the sequence of delivery, with the word "then" between, indicates the expected order of execution;

EXAMPLE:

DESCEND AND MAINTAIN (altitude) THEN REDUCE SPEED TO (speed).

EXAMPLE:

REDUCE SPEED TO (speed) THEN DESCEND AND MAINTAIN (altitude).

NOTE.— The maximum speeds below 10,000 feet as established in FAR—91.70 still apply. If there is any doubt concerning the manner in which such a clearance is to be executed, request clarification from ATC.

f. If ATC determines (before an approach clearance is issued) that it is no longer necessary to apply speed adjustment procedures, they will inform the pilot to resume normal speed. Approach clearances supersede any prior speed adjustment assignments and pilots are expected to make their own speed adjustments, as necessary, to complete the approach. Under certain circumstances; however, it may be necessary for ATC to request further speed adjustments after approach clearance is issued to maintain separation between successive arrivals. Under such circumstances previously issued speed adjustments will be restated if that speed is to be maintained or additional speed adjustments are requested. ATC must obtain pilot concurrence for speed adjustments after approach clearances are issued.

g. Controllers have been advised that utilization of the minimum speeds set forth above for reciprocating engine aircraft will sometimes be impractical, since some aircraft in this category cruise at lower speeds and cannot attain the speeds specified. Speed adjustment of reciprocating engine or turbine powered aircraft which cannot attain the minimum speeds set forth shall be accomplished by requesting such flight to, if practical:

(1) Maintain a specified speed equivalent to that of the preceding or succeeding aircraft; or

(2) Increase or decrease speed utilizing increments of 10 knots or multiples thereof.

h. The pilots retain the prerogative of rejecting the application of speed adjustment by ATC if the minimum safe airspeed for any particular operation is greater than the speed adjustment. IN SUCH CASES, PILOTS ARE EXPECTED TO ADVISE ATC OF THE SPEED THAT WILL BE USED.

i. Pilots are reminded that they are responsible for rejecting the application of speed adjustment by ATC if, in their opinion, it will cause them to exceed the maximum indicated airspeed prescribed by FAR—91.70(a). IN SUCH CASES, THE PILOT IS EXPECTED TO SO INFORM ATC. Pilots operating at or above 10,000 feet MSL who are issued speed adjustments which exceed 250 knots IAS and are subsequently cleared below 10,000 feet MSL are expected to comply with FAR—91.70(a).

j. For operations in an airport traffic area, ATC is authorized to request or approve a speed greater than the maximum indicated airspeeds prescribed for operation within that airspace (FAR—91.70(b)).

k. When in communication with the ARTCC, pilots should, as a good operating practice, state any ATC assigned speed restriction on initial radio contact associated with an ATC communications frequency change.

273. RUNWAY SEPARATION

Tower controllers establish the sequence of arriving and departing aircraft by requiring them to adjust flight or ground operation as necessary to achieve proper spacing. They may "HOLD" an aircraft short of the runway to achieve spacing between it and an arriving aircraft; the controller may instruct a pilot to "EXTEND DOWNWIND" in order to establish spacing from an arriving or departing aircraft. At times a clearance may include the word "IMMEDIATE." For example: "CLEARED FOR IMMEDIATE TAKEOFF." In such cases, "IMMEDIATE" is used for purposes of *air traffic separation*. It is up to the pilot to refuse the clearance if, in his opinion, compliance would adversely affect his operation. (See PARA—236 - GATE HOLDING DUE TO DEPARTURE DELAYS.)

274. VISUAL SEPARATION

a. Visual separation is a means employed by ATC to separate aircraft only in terminal areas. There are two methods employed to effect this separation:

(1) The tower controller sees the aircraft involved and issues instructions, as necessary, to ensure that the aircraft avoid each other.

(2) A pilot sees the other aircraft involved and upon instructions from the controller provides his own separation by maneuvering his aircraft to avoid it. This may involve following in-trail behind another aircraft or keeping it in sight until it is no longer a factor.

b. A pilot's acceptance of instructions to follow another aircraft or provide visual separation from it is an acknowledgment that the pilot will maneuver his/her aircraft as necessary to avoid the other aircraft or to maintain in-trail separation. In operations conducted behind heavy jet aircraft, it is also an acknowledgment that the pilot accepts the responsibility for wake turbulence separation.

c. WHEN A PILOT HAS BEEN TOLD TO FOLLOW ANOTHER AIRCRAFT OR TO PROVIDE VISUAL SEPARATION FROM IT HE/SHE SHOULD PROMPTLY NOTIFY THE CONTROLLER IF VISUAL CONTACT WITH THE OTHER AIRCRAFT IS LOST OR CANNOT BE MAINTAINED OR IF THE PILOT CANNOT ACCEPT THE RESPONSIBILITY FOR THE SEPARATION FOR ANY REASON.

d. Pilots should remember, however, that they have a regulatory responsibility (FAR 91.67(a)) to see and avoid other aircraft when weather conditions permit.

275. USE OF VISUAL CLEARING PROCEDURES

a. Before Takeoff. Prior to taxiing onto a runway or landing area in preparation for takeoff, pilots should scan the approach areas for possible landing traffic, executing appropriate clearing maneuvers to provide him a clear view of the approach areas.

b. Climbs and Descents. During climbs and descents in flight conditions which permit visual detection of other traffic, pilots should execute gentle banks, left and right at a frequency which permits continuous visual scanning of the airspace about them.

c. Straight and level. Sustained periods of straight and level flight in conditions which permit visual detection of other traffic should be broken at intervals with appropriate clearing procedures to provide effective visual scanning.

d. Traffic pattern. Entries into traffic patterns while descending create specific collision hazards and should be avoided.

e. Traffic at VOR sites. All operators should emphasize the need for sustained vigilance in the vicinity of VORs and airway intersections due to the convergence of traffic.

f. Training operations. Operators of pilot training programs are urged to adopt the following practices:

(1) Pilots undergoing flight instruction at all levels should be requested to verbalize clearing procedures (call out, "clear" left, right, above or below) to instill and sustain the habit of vigilance during maneuvering.

(2) High-wing airplane, momentarily raise the wing in the direction of the intended turn and look.

(3) Low-wing airplane, momentarily lower the wing in the direction of the intended turn and look.

(4) Appropriate clearing procedures should precede the execution of all turns including chandelles, lazy eights, stalls, slow flight, climbs, straight and level, spins and other combination maneuvers.

276—289. RESERVED

Section 5. PREFLIGHT

290. PREFLIGHT PREPARATION

a. Every pilot is urged to receive a preflight briefing and to file a flight plan. This briefing should consist of weather, airport, and en route NAVAID information. Briefing service may be obtained from a FSS either by telephone or interphone, by radio when airborne, or by a personal visit to the station.

b. For your convenience, you are urged to use the Flight Planner which is printed on FAA Form 8740-2. It provides a flight log, a reproduction of FAA Form 7233-1, Flight Plan, blocks to record weather and aeronautical data and a "go or no go" checklist. The Flight Planner and Flight Plan forms are available for use at all flight service stations. Additional copies will be provided on request.

c. Consult an FSS or Weather Service Office (WSO) for preflight weather briefing.

d. FSSs are required to advise of pertinent NOTAMs, but if they are overlooked, don't hesitate to remind the specialist that you have not received NOTAM information.

NOTE.— NOTAMS which are known in sufficient time for publication and are of 7 days duration or longer are normally incorporated into the Notices to Airmen (Class II) publication and carried there until cancellation time. FDC NOTAMs, which apply to instrument flight procedures, are also included in the Notices to Airmen publication up to and including the number indicated in the FDC NOTAM legend. Class II NOTAMs are not provided during a briefing unless specifically requested by the pilot since the FSS specialist has no way of knowing whether the pilot has already checked the Notices to Airmen (Class II) publication prior to calling. Remember to *ask* for Class II NOTAMs in the Notices to Airmen publication. This information is not normally furnished during your briefing. (See PARA—294 - NOTICE TO AIRMEN (NOTAM) SYSTEM.)

e. Pilots are urged to use only the latest issue of aeronautical charts in planning and conducting flight operations. Aeronautical charts are revised and reissued on a regular scheduled basis to ensure that depicted data are current and reliable. In the conterminous U.S., Sectional Charts are updated each 6 months, IFR En route Charts each 56 days, and amendments to civil IFR Approach Charts are accomplished on a 56 day cycle with a change notice volume issued on the 28 day midcycle. Charts that have been superseded by those of a more recent date may contain obsolete or incomplete flight information. (See PARA—623 - GENERAL DESCRIPTION OF EACH CHART SERIES.)

f. When requesting a preflight briefing, identify yourself as a pilot and provide the following:

(1) Type of flight planned, e.g., VFR or IFR.
(2) Aircraft number or pilot's name.
(3) Aircraft type.
(4) Departure Airport.
(5) Route of flight.
(6) Destination.
(7) Flight altitude(s).
(8) ETD and ETE.

g. Prior to conducting a briefing, briefers are required to havethe background information listed above so that they may tailor the briefing to the needs of the proposed flight. The objective is to communicate a "picture" of meteorological and aeronautical information necessary for the conduct of a safe and efficient flight. Briefers use all available weather and aeronautical information to summarize data applicable to the proposed flight. They do not read weather reports and forecasts verbatim unless specifically requested by the pilot. Refer to PARA—502 for those items of a weather briefing that should be expected or requested.

h. In addition to the filing of a flight plan, if the flightwill traverse or land in one or more foreign countries, it is particularly important that pilots leave a complete itinerary with someone directly concerned, keep that person advised of the flight's progress and inform him that, if serious doubt arises as to the safety of the flight, he should first contact the FSS. (See PARA—300 - FLIGHTS OUTSIDE THE UNITED STATES AND U.S. TERRITORIES.)

i. Pilots operating under provisions of FAR—135, and not havingan FAA assigned 3-letter designator, are urged to prefix the normal registration (N) number with the letter "T" on flight plan filing, (e.g., TN1234B). (See PARA—193 - AIRCRAFT CALL SIGNS.)

291. FOLLOW IFR PROCEDURES EVEN WHEN OPERATING VFR

a. To maintain IFR proficiency, pilots are urged to practice IFR procedures whenever possible, even when operating VFR. Some suggested practices include:

(1) Obtain a complete preflight and weather briefing. Check the NOTAMS.

(2) File a flight plan. This is an excellent low cost insurance policy. The cost is the time it takes to fill it out. The insurance includes the knowledge that someone will be looking for you if you become overdue at your destination.

(3) Use current charts.

(4) Use the navigation aids. Practice maintaining a good course—keep the needle centered.

(5) Maintain a constant altitude which is appropriate for the direction of flight.

(6) Estimate en route position times.

(7) Make accurate and frequent position reports to the FSSs along your route of flight.

b. Simulated IFR flight is recommended (under the hood); however, pilots are cautioned to review and adhere to the requirements specified in FAR—91.21 before and during such flight.

c. When flying VFR at night, in addition to the altitude appropriate for the direction of flight, pilots should maintain an altitude which is at or above the minimum en route altitude as shown on charts. This is especially true in mountainous terrain, where there is usually very little ground reference. Do not depend on your eyes alone to avoid rising unlighted terrain, or even lighted obstructions such as TV towers.

292—293. RESERVED

294. NOTICE TO AIRMEN (NOTAM) SYSTEM

a. Time-critical aeronautical information which is of either a temporary nature or is not sufficiently known in advance to permit publication on aeronautical charts or in other operational publications, receives immediate dissemination via the National Notice to Airmen (NOTAM) System.

NOTE.— NOTAM information is that aeronautical information that could affect a pilot's decision to make a flight. It includes such information as airport or primary runway closures, changes in the status of navigational aids, ILSs, radar service availability, and other information essential to planned enroute, terminal or landing operations.

b. NOTAM information is classified into three categories. These are NOTAM (D) or distant, NOTAM (L) or local, and Flight Data Center (FDC) NOTAMs.

(1) NOTAM (D)

(a) NOTAM (D) information is disseminated for all navigational facilities that are part of the National Airspace System (NAS), all IFR airports with approved IAPs, and for those VFR airports annotated with the Notam Service Symbol(§) in the Airport/Facility Directory (A/FD). The complete file of all NOTAM (D) information is maintained in a computer data base at the National Communications Center (NATCOM), located in Kansas City. This category of information is distributed automatically, appended to the hourly weather reports, via the Service A telecommunications system. Air traffic facilities, primarily FSS, with Service A capability, have access to the entire NATCOM data base of NOTAMs. These NOTAMs remain available via Service A for the duration of their validity or until published.

(2) NOTAM (L)

(a) NOTAM (L) information includes such data as taxiway closures, men and equipment near or crossing runways, airport rotating beacon outages, and airport lighting aids that do not affect instrument approach criteria, such as VASI. This category of NOTAM also contains all NOTAM information concerning airports that are not annotated with the Notam Service Symbol in the A/FD, including airport and runway closures.

(b) NOTAM (L) information is distributed locally only, and is not attached to the hourly weather reports. A separate file of local NOTAMs is maintained at each FSS, for facilities in their area only. NOTAM (L) information for other FSS areas must be specifically requested directly from the FSS that has responsibility for the airport concerned.

(3) FDC NOTAMS

(a) On those occasions when it becomes necessary to disseminate information which is requlatory in nature, the National Flight Data Center (NFDC), in Washington, D.C., will issue an FDC NOTAM. FDC NOTAMs contain such things as amendments to published IAPs and other current aeronautical charts. They are also used to advertise temporary flight restrictions caused by such things as natural disasters or large scale public events, that may generate a congestion of air traffic over a site.

(b) FDC NOTAMs are transmitted via Service A only once, and are kept on file at the FSS until published or cancelled. FSSs are responsible for maintaining a file of current, unpublished FDC NOTAMs concerning conditions within 400 miles of their facilities. FDC information concering conditions that are more than 400 miles from the FSS, or that is already published, is given to a pilot only on request.

c. An integral part of the NOTAM System is the biweekly Notice to Airmen (Class II) publication. Data is included in this publication to reduce congestion on the telecommunications circuits, and therefore is not available via Service A. This information once published, is not provided during pilot weather briefings unless specifically requested by the pilot.

NOTE.— The term "Class II" refers to the fact that the NOTAMs or notices, appear in printed form for mail distribution as opposed to NOTAMs which are distributed via telecommunications. The latter are considered Class I.

(1) This publication contains two sections:

(a) The first section consists of notices which meet the criteria for NOTAM (D), and are expected to remain in effect for an extended period, and FDC NOTAMs current at the time of publication. Occasionally, some NOTAM (L) and other unique information is included in this section when it will contribute to flight safety.

(b) The second section contains special notices that are too long or concern a wide or unspecified geographic area and are not suitable for inclusion in the first section. The content of these notices vary widely and there are no specific criteria for their inclusion, other than their enhancement of flight safety.

(c) The number of the last FDC NOTAM included in the publication, is noted on the first page to aid the user, in updating the listing contained, with any FDC NOTAMs which may have been issued between the cut-off date and the date the publication is received. All information contained will be carried until the information expires, is cancelled, or in the case of permanent conditions, is published in other publications, such as the A/FD.

(d) All new notices entered, excluding FDC NOTAMs, will be published only if the information is expected to remain in effect for at least 7 days after the effective date of the publication.

295. FLIGHT PLAN — VFR FLIGHTS

a. Except for operations in or penetrating a Coastal or Domestic ADIZ or DEWIZ (See PARA—430 - NATIONAL SECURITY), a flight plan is not required for VFR flight. However, it is strongly recommended that one be filed with an FAA FSS. This will ensure that you receive VFR Search and Rescue Protection. (Refer to PARA—456.g. for the proper method of filing.)

b. To obtain maximum benefits from the flight plan program, flight plans should be filed directly with the nearest FSS. For your convenience, FSSs provide aeronautical and meteorological briefings while accepting flight plans. Radio may be used to file if no other means are available.

NOTE.— Some states operate aeronautical communications facilities which will accept and forward flight plans to the FSS for further handling.

c. When a "stopover" flight is anticipated, it is recommended that a separate flight plan be filed for each "leg" when the stop is expected to be more than 1 hour duration.

d. Pilots are encouraged to give their departure times directly to the FSS serving the departure airport or as otherwise indicated by the FSS when the flight plan is filed. This will ensure more efficient flight plan service and permit the FSS to advise you of significant changes in aeronautical facilities or meteorological conditions. When a VFR flight plan is filed, it will be held by the FSS until 1 hour after the proposed departure time unless:

(1) The actual departure time is received.

(2) A revised proposed departure time is received.

(3) At a time of filing, the FSS is informed that the proposed departure time will be met, but actual time cannot be given because of inadequate communications (assumed departures).

e. On pilot's request, at a location having an active tower, the aircraft identification will be forwarded by the FSS to the tower for reporting the actual departure time. This procedure should be avoided at busy airports.

f. Although position reports are not required for VFR flight plans, periodic reports to FAA, FSSs along the route are good practice. Such contacts permit significant information to be passed to the transiting aircraft and also serve to check the progress of the flight should it be necessary for any reason to locate the aircraft.

EXAMPLE:

BONANZA 314K, OVER KINGFISHER AT (Time), VFR FLIGHT PLAN, TULSA TO AMARILLO.

EXAMPLE:

CHEROKEE 5133J, OVER OKLAHOMA CITY AT (Time), SHREVEPORT TO DENVER, NO FLIGHT PLAN.

g. Pilots not operating on an IFR flight plan, and when in level cruising flight, are cautioned to conform with VFR cruising altitudes appropriate to direction of flight.

h. Indicate aircraft equipment capabilities when filing VFR flight plans by appending the appropriate suffix to aircraft type in the same manner as that prescribed for IFR flight (see PARA—298 — FLIGHT PLAN - IFR FLIGHTS). Under some circumstances, ATC computer tapes can be useful in constructing the radar history of a downed or crashed aircraft. In each case, knowledge of the aircraft's transponder equipment is necessary in determining whether or not such computer tapes might prove effective.

296. FLIGHT PLAN — DEFENSE VFR (DVFR) FLIGHTS

VFR flights into a Coastal or Domestic ADIZ/DEWIZ are required to file a VFR flight plan for security purposes. Detailed ADIZ procedures are found in the National Security section of this chapter. (See FAR—99.)

297. COMPOSITE FLIGHT PLAN (VFR/IFR FLIGHTS)

a. Flight plans which specify VFR operation for one portion of a flight, and IFR for another portion, will be accepted by the FSS at the point of departure. If VFR flight is conducted for the first portion of the flight, the pilot should report his departure time to the FSS with which he filed his VFR/IFR flight plan; and, subsequently, close the VFR portion and request ATC clearance from the FSS nearest the point at which change from VFR to IFR is proposed. Regardless of the type facility you are communicating with (FSS, center, or tower), it is the pilot's responsibility to request that facility to "CLOSE VFR FLIGHT PLAN." The pilot must remain in VFR weather conditions until operating in accordance with the IFR clearance.

b. When a flight plan indicates IFR for the first portion of flight and VFR for the latter portion, the pilot will normally be cleared to the point at which the change is proposed. Once the pilot has reported over the clearance limit and does not desire further IFR clearance, he should advise ATC to cancel the IFR portion of his flight plan. Then, he should contact the nearest FSS to activate the VFR portion of his flight plan. If the pilot desires to continue his IFR flight plan beyond the clearance limit, he should contact ATC at least 5 minutes prior to the clearance limit and request further IFR clearance. If the requested clearance is not received prior to reaching the clearance limit fix, the pilot will be expected to established himself in a standard holding pattern on the radial or course to the fix unless a holding pattern for the clearance limit fix is depicted on a U.S. Government or commercially produced (meeting FAA requirements) Low or High Altitude En Route, Area or STAR Chart. In this case the pilot will hold according to the depicted pattern.

298. FLIGHT PLAN — IFR FLIGHTS

a. GENERAL

(1) Prior to departure from within, or prior to entering controlled airspace, a pilot must submit a complete flight plan and receive an air traffic clearance, if weather conditions are below VFR minimums. Instrument flight plans may be submitted to the nearest FSSs or ATCT either in person or by telephone (or by radio if no other means are available). Pilots should file IFR flight plans at least 30 minutes prior to estimated time of departure to preclude possible delay in receiving a departure clearance from ATC. To minimize your delay in entering the control zone at destination when IFR weather conditions exist or are forecast at that airport, an IFR flight plan should be filed before departure. Otherwise, a 30 minute delay is not unusual in receiving an ATC clearance because of time spent in processing flight plan data. Traffic saturation frequently prevents control personnel from accepting flight plans by radio. In such cases, the pilot is advised to contact the nearest FSS for the purpose of filing the flight plan.

NOTE.— There are several methods of obtaining IFR clearances at nontower, non-FSSs, and outlying airports. The procedure may vary due to geographical features, weather conditions, and the complexity of the ATC system. To determine the most effective means of receiving an IFR clearance, pilots should ask the nearest FSS the most appropriate means of obtaining the IFR clearance.

(2) When filing an IFR flight plan for a Heavy aircraft, add the prefix H to the aircraft type.

EXAMPLE:

H/DC10/U

(3) When filing an IFR flight plan for flight in an aircraft equipped with a radar beacon transponder, DME equipment, TACAN only equipment or a combination of both, identify equipment capability by adding a suffix to the AIRCRAFT TYPE preceded by a slant, as follows:

/X — no transponder.

/T — transponder with no altitude encoding capability.

/U — transponder with altitude encoding capability.

/D — DME, but no transponder.

/B — DME and transponder, but no altitude encoding capability.

/A — DME and transponder with altitude encoding capability.

/M — TACAN only, but no transponder.

/N — TACAN only and transponder, but with no altitude encoding capability.

/P — TACAN only and transponder with altitude encoding capability.

/C — RNAV and transponder, but with no altitude encoding capability.

/R — RNAV and transponder with altitude encoding capability.

/W — RNAV but no transponder.

(4) It is recommended that pilots file the maximum transponder or navigation capability of their aircraft in the equipment suffix. This will provide ATC with the necessary information to utilize all facets of navigational equipment and transponder capabilities available. In the case of area navigation equipped aircraft, pilots should file the /C, /R, or /W capability of the aircraft even though an RNAV route or random RNAV route has not been requested. This will ensure ATC awareness of the pilot's ability to navigate point-to-point and may be utilized to expedite the flight.

NOTE.— The suffix is not to be added to the aircraft identification or be transmitted by radio as part of the aircraft identification.

b. AIRWAYS/JET ROUTES DEPICTION ON FLIGHT PLAN

(1) It is vitally important that the route of flight be accurately and completely described in the flight plan. To simplify definition of the proposed route, and to facilitate ATC, pilots are requested to file via airways or jet routes established for use at the altitude or flight level planned.

(2) If flight is to be conducted via designated airways or jet routes, describe the route by indicating the type and number designators of the airway(s) or jet route(s) requested. If more than one airway or jet route is to be used, clearly indicate points of transition. If the transition is made at an unnamed intersection, show the next succeeding NAVAID or named intersection on the intended route and the complete route from that point. Reporting points may be identified by using authorized name/code as depicted on appropriate aeronautical charts. The following two examples illustrate the need to specify the transition point when two routes share more than one transition fix.

EXAMPLE:

FL 250 ALB J37 BUMPY J14 BHM

SPELLED OUT: Requesting Flight Level 250 from Albany, New York, via Jet Route 37 transitioning to Jet Route 14 at BUMPY intersection, thence via Jet Route 14 to Birmingham, Alabama.

EXAMPLE:

FL 250 ALB J37 ENO J14 BHM

SPELLED OUT: Requesting Flight Level 250 from Albany, New York, via Jet Route 37 transitioning to Jet Route 14 at Kenton VORTAC (ENO) thence via Jet Route 14 to Birmingham, Alabama.

(a) The route of flight may also be described by naming the reporting points or NAVAIDs over which the flight will pass, provided the points named are established for use at the altitude or flight level planned.

EXAMPLE:

30 BWI V44 SWANN V433 DQO

SPELLED OUT: Requesting 3,000 feet from Baltimore Washington International, via Victor 44 To Swann Intersection, transitioning to Victor 433 at Swann, thence via V433 to Dupont.

(b) When the route of flight is defined by named reporting points, whether alone or in combination with airways or jet routes, and the navigational aids (VOR, VORTAC, TACAN, NDB) to be used for the flight are a combination of different types of aids, enough information should be included to clearly indicate the route requested.

EXAMPLE:

FL 310 LAX J5 LKV J3 GEG YXC FL 330 HL500 VLR HL515 YWG

SPELLED OUT: Requesting FL 310 from Los Angeles International via Jet Route 5 Lakeview, Jet Route 3 Spokane, direct Kimberly, British Columbia Low Frequency Range, Flight Level 330 High Level Airway 500 to Langruth, Manitoba VOR, High Level Airway 515 to Winnepeg, Manitoba.

(c) When filing IFR, it is to the pilot's advantage to file a preferred route.

NOTE.— Preferred IFR routes are described and tabulated in the Airport/Facility Directory.

(d) ATC may issue a SID or a STAR, as appropriate. (See PARA—325 - INSTRUMENT DEPARTURE and PARA—360 - STANDARD TERMINAL ARRIVAL (STAR).)

NOTE.— Pilots not desiring a SID or STAR should so indicate in the remarks section of the flight plan as "NO SID" or "NO STAR".

c. DIRECT FLIGHTS

(1) All or any portions of the route which will not be flown on the radials or courses of established airways or routes, such as direct route flights, must be defined by indicating the radio fixes over which the flight will pass. Fixes selected to define the route shall be those over which the position of the aircraft can be accurately determined. Such fixes automatically become compulsory reporting points for the flight, unless advised otherwise by ATC. Only those navigational aids established for use in a particular structure, i.e., in the low or high structures, may be used to define the en route phase of a direct flight within that altitude structure.

(2) The azimuth feature of VOR aids and that azimuth and distance (DME) features of VORTAC and TACAN aids are assigned certain frequency protected areas of airspace which are intended for application to established airway and route use, and to provide guidance for planning flights outside of established airways or routes. These areas of airspace are expressed in terms of cylindrical service volumes of specified dimensions called "class limits" or "categories." (See PARA—10 - CLASS OF NAVAIDs.) An operational service volume has been established for each class in which adequate signal coverage and frequency protection can be assured. To facilitate use of VOR, VORTAC or TACAN aids, consistent with their operational service volume limits, pilot use of such aids for defining a direct route of flight in controlled airspace should not exceed the following:

(a) Operations above FL 450 — use aids not more than 200 NM apart. These aids are depicted on En Route High Altitude Charts.

(b) Operation off established routes from 18,000 feet MSL to FL 450 - use aids not more than 260 NM apart. These aids are depicted on En Route High Altitude Charts.

(c) Operation off established airways below 18,000 feet MSL — use aids not more than 80 NM apart. These aids are depicted on En Route Low Altitude Charts.

(d) Operation off established airways between 14,500 feet MSL and 17,999 feet MSL in the conterminous U.S. — (H) facilities not more than 200 NM apart may be used.

(3) Increasing use of self-contained airborne navigational systems which do not rely on the VOR/VORTAC/TACAN system has resulted in pilot requests for direct routes which exceed NAVAID service volume limits. These direct route requests will be approved only in a radar environment, with approval based on pilot responsibility for navigation on the authorized direct route. Radar flight following will be provided by ATC for ATC purposes.

(4) At times, ATC will initiate a direct route in a radar environment which exceeds NAVAID service volume limits. In such cases ATC will provide radar monitoring and navigational assistance as necessary.

(5) Airway or jet route numbers, appropriate to the stratum in which operation will be conducted, may also be included to describe portions of the route to be flown.

EXAMPLE:

140 MDW V262 BDF V10 BRL STJ SLN GCK

SPELLED OUT: Requesting 14,000 feet from Chicago Midway Airport via Victor 262 to Bradford, Victor 10 to Burlington, Iowa, direct St. Joseph, Missouri, direct Salina, Kansas, direct Garden City, Kansas.

NOTE.— When route of flight is described by radio fixes, the pilot will be expected to fly a direct course between the points named.

(6) Pilots are reminded that they are responsible for adhering to obstruction clearance requirements on those segments of direct routes that are outside of controlled airspace. The MEA's and other altitudes shown on Low Altitude IFR En Route Charts pertain to those route segments within controlled airspace, and those altitudes may not meet obstruction clearance criteria when operating off those routes.

d. AREA NAVIGATION (RNAV)

(1) Random RNAV routes can only be approved in a radar environment. Factors that will be considered by ATC in approving random RNAV routes include the capability to provide radar monitoring and compatibility with traffic volume and flow. ATC will radar monitor each flight, however, navigation on the random RNAV route is the responsibility of the pilot.

(2) To be certified for use in the National Airspace System, RNAV equipment must meet the specifications outlined in AC 90-45. The pilot is responsible for variations in equipment capability, and must advise ATC if a RNAV clearance can not be accepted as specified. The controller need only be concerned that the aircraft is RNAV equipped; if the flight plan equipment suffix denotes RNAV capability, the RNAV routing can be applied.

(3) Pilots of aircraft equipped with operational area navigation equipment may file for random RNAV routes throughout the National Airspace System, where radar monitoring by ATC is available, in accordance with the following procedures.

(a) File airport to airport flight plans prior to departure.

(b) File the appropriate RNAV capability certification suffix in the flight plan.

(c) Plan the random route portion of the flight plan to begin and end over appropriate arrival and departure transition fixes or appropriate navigation aids for the altitude stratum within which the flight will be conducted. The use of normal preferred departure and arrival routes (SID/STAR), where established, is recommended.

(d) File route structure transitions to and from the random route portion of the flight.

(e) Define the random route by waypoints. File route description waypoints by using degree-distance fixes based on navigational aids which are appropriate for the altitude stratum.

(f) File a minimum of one route description waypoint for each ARTCC through whose area the random route will be flown. These waypoints must be located within 200 NM of the preceding center's boundary.

(g) File an additional route description waypoint for each turnpoint in the route.

(h) Plan additional route description waypoints as required to ensure accurate navigation via the filed route of flight. Navigation is the pilots's responsibility unless ATC assistance is requested.

(i) Plan the route of flight so as to avoid Prohibited and Restricted Airspace by 3 NM unless permission has been obtained to operate in that airspace and the appropriate ATC facilities are advised.

(4) Pilots of aircraft equipped with latitude/longitude coordinate navigation capability, independent of VOR/TACAN references, may file for random RNAV routes at and above FL 390, within the conterminous United States, using the following procedures.

(a) File airport to airport flight plans prior to departure.

(b) File the appropriate RNAV capability certification suffix in the flight plan.

(c) Plan the random route portion of the flight to begin and end over published departure/arrival transition fixes or appropriate navigation aids for airports without published transition procedures. The use of preferred departure and arrival routes, such as SID and STAR where established, is recommended.

(d) Plan the route of flight so as to avoid prohibited and restricted airspace by 3 NM unless permission has been obtained to operate in that airspace and the appropriate ATC facility is advised.

(e) Define the route of flight after the departure fix, including each intermediate fix (turnpoint) and the arrival fix for the destination airport in terms of latitude/longitude coordinates plotted to the nearest minute. The arrival fix must be identified by both the latitude/longitude coordinates and a fix identifier.

Example:

MIA [1] SRQ [2] 3407/10615 [3] 3407/11546 TNP [4] LAX [5]

1. Departure airport.
2. Departure fix.
3. Intermediate fix (turning point).
4. Arrival fix.
5. Destination airport.

(f) Record latitude/longitude coordinates by four figures describing latitude in degrees and minutes followed by a solidus and five figures describing longitude in degrees and minutes.

(g) File at FL 390 or above for the random RNAV portion of the flight.

(h) Fly all routes/route segments on Great Circle tracks.

(i) Make any inflight requests for random RNAV clearances or route amendments to an en route ATC facility.

299. IFR OPERATIONS TO HIGH ALTITUDE DESTINATIONS

a. Pilots planning IFR flights to airports located in mountainous terrain are cautioned to consider the necessity for an alternate airport even when the forecast weather conditions would technically relieve them from the requirement to file one (Reference: FAR—91.23(b)). The FAA has identified three possible situations where the failure to plan for an alternate airport when flying IFR to such a destination airport could result in a critical situation if the weather is less than forecast and sufficient fuel is not available to proceed to a suitable airport.

(1) An IFR flight to an airport where the MDAs or landing visibility minimums for*ALL INSTRUMENT APPROACHES* are higher than the forecast weather minimums specified in FAR—91.23(b). For example, there are 10 high altitude airports in the United States with approved instrument approach procedures where all of the Minimum Descent Altitudes (MDAs) are greater than 2000 feet and/or the landing visibility minimums are greater than 3 miles (Bishop, California; South Lake Tahoe, California; Ukiah, California; Butte, Montana; Helena, Montana; Missoula, Montana; Chadron, Nebraska; Ely, Nevada; Klamath Falls, Oregon; and Omak, Washington). In the case of these 10 airports, it is possible for a pilot to elect, on the basis of forecasts, not to carry sufficient fuel to get to an alternate when the ceiling and/or visibility is actually lower than that necessary to complete the approach.

(2) A small number of other airports in mountainous terrain have MDAs which are slightly (100 to 300 feet) below 2000 feet AGL. In situations where there is an option as to whether to plan for an alternate, pilots should bear in mind that just a slight worsening of the weather conditions from those forecast could place the airport below the published IFR landing minimums.

(3) An IFR flight to an airport which requires special equipment, i.e., DME, glide slope, etc., in order to make the available approaches to the lowest minimums. Pilots should be aware that all other minimums on the approach charts may require weather conditions better than those specified in FAR—91.23(b). An inflight equipment malfunction could result in the inability to comply with the published approach procedures or, again, in the position of having the airport below the published IFR landing minimums for all remaining instrument approach alternatives.

300. FLIGHTS OUTSIDE THE UNITED STATES AND U.S. TERRITORIES

a. When conducting flights, particularly extended flights, outside the U.S. and its territories, full account should be taken of the amount and quality of air navigation services available in the airspace to be traversed. Every effort should be made to secure information on the location and range of navigational aids, availability of communications and meterological services, the provision of air traffic services, including alerting service, and the existence of search and rescue services.

b. Pilots should remember that there is a need to continuously guard the VHF emergency frequency 121.5 MHz when on long over-water flights, except when communications on other VHF channels, equipment limitations, or cockpit duties prevent simultaneous guarding of two channels. Guarding of 121.5 MHz is particularly critical when operating in proximity to flight information region (FIR) boundaries, for example, operations on Route R220 between Anchorage and Tokyo, since it serves to facilitate communications with regard to aircraft which may experience in-flight emergencies, communications, or navigational difficulities. (Reference ICAO Annex 10, Vol II Paras 5.2.2.1.1.1 and 5.2.2.1.1.2.)

c. The filing of a flight plan, always good practice, takes on added significance for extended flights outside U.S. airspace and is, in fact, usually required by the laws of the countries being visited or overflown. It is also particularly important in the case of such flights that pilots leave a complete itinerary and schedule of the flight with someone directly concerned, keep that person advised of the flight's progress and inform him that if serious doubt arises as to the safety of the flight he should first contact the appropriate FSS.

d. All pilots should review the foreign airspace and entry restrictions published in the IFIM during the flight planning process. Foreign airspace penetration without official authorization can involve both danger to the aircraft and the imposition of severe penalties and inconvenience to both passengers and crew. A flight plan on file with ATC authorities does not necessarily constitute the prior permis

sion required by certain other authorities. The possibility of fatal consequences cannot be ignored in some areas of the world.

e. Current NOTAMs for foreign locations must also be reviewed. The publication International Notices to Airmen, published biweekly, contains considerable information pertinent to foreign flight. Current foreign NOTAMs are also available from the U.S. International NOTAM Office in Washington, D.C., through any local FSS.

f. When customs notification is required, it is the responsibility of the pilot to arrange for customs notification in a timely manner. The following guidelines are applicable:

(1) When customs notification is required on flights to Canada and Mexico and a predeparture flight plan cannot be filed or an advise customs message (ADCUS) cannot be included in a predeparture flight plan, call the nearest en route domestic or International FSS as soon as radio communication can be established and file a VFR or DVFR flight plan, as required, and include as the last item the advise customs information. The station with which such a flight plan is filed will forward it to the appropriate FSS who will notify the customs office responsible for the destination airport.

(2) If the pilot fails to include ADCUS in the radioed flight plan, it will be assumed that other arrangements have been made and FAA will not advise customs.

(3) The FAA assumes no responsibility for any delays in advising customs if the flight plan is given too late for delivery to customs before arrival of the aircraft. It is still the pilot's responsibility to give timely notice even though a flight plan is given to FAA.

301. CHANGE IN FLIGHT PLAN

In addition to altitude or flight level, destination and/or route changes, increasing or decreasing the speed of an aircraft constitutes a change in a flight plan. Therefore, at any time the average true airspeed at cruising altitude between reporting points varies or is expected to vary from that given in the flight plan by *plus or minus 5 percent, or 10 knots, whichever is greater,* ATC should be advised.

302. CHANGE IN PROPOSED DEPARTURE TIME

a. To prevent computer saturation in the en route environment, parameters have been established to delete proposed departure flight plans which have not been activated. Most centers have this parameter set so as to delete these flight plans a minimum of 1 hour after the proposed departure time. To ensure that a flight plan remains active, pilots whose actual departure time will be delayed 1 hour or more beyond their filed departure time, are requested to notify ATC of their departure time.

b. Due to traffic saturation, control personnel frequently will be unable to accept these revisions via radio. It is recommended that you forward these revisions to the nearest FSS.

303. CLOSING VFR/DVFR FLIGHT PLANS

A pilot is responsible for ensuring that his VFR or DVFR flight plan is cancelled (FAR—91.83). You should close your flight plan with the nearest FSS, or if one is not available, you may request any ATC facility to relay your cancellation to the FSS. *Control towers do not automatically close VFR or DVFR flight plans* since they do not know if a particular VFR aircraft is on a flight plan. If you fail to report or cancel your flight plan within 1/2 hour after your ETA, Search and Rescue procedures are started.

304. CANCELLING IFR FLIGHT PLAN

a. FAR—91.83 includes the statement "When a flight plan has been filed, the pilot in command, upon cancelling or completing the flight under the flight plan, shall notify the nearest FSS or ATC facility."

b. An IFR flight plan may be cancelled at any time the flight is operating in VFR conditions outside positive controlled airspace by the pilot stating "CANCEL MY IFR FLIGHT PLAN" to the controller or air/ground station with which he is communicating. Immediately after cancelling an IFR flight plan, a pilot should take necessary action to change to the appropriate air/ground frequency, VFR radar beacon code and VFR altitude or flight level.

c. ATC separation and information services will be discontinued, including radar services (where applicable). Consequently, if the cancelling flight desires VFR radar advisory service, the pilot must specifically request it.

NOTE.— Pilots must be aware that other procedures may be applicable to a flight that cancels an IFR flight plan within an area where a special program has been established such as a designated TRSA or TCA.

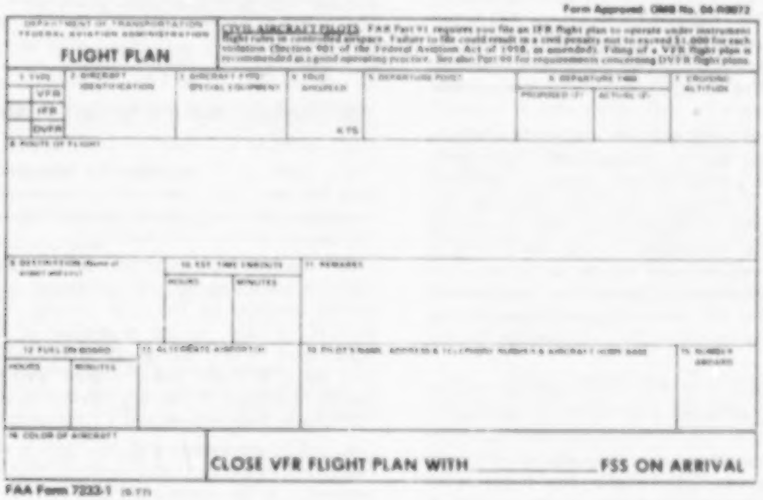
d. If a DVFR flight plan requirement exists, the pilot is responsible for filing this flight plan to replace the cancelled IFR flight plan. If a subsequent IFR operation becomes necessary, a new IFR flight plan must be filed and an ATC clearance obtained before operating in IFR conditions.

e. If operating on an IFR flight plan to an airport with a functioning control tower, the flight plan is automatically closed upon landing.

f. If operating on an IFR flight plan to an airport where there is no functioning control tower, the pilot must initiate cancellation of the IFR flight plan. This can be done after landing if there is a functioning FSS or other means of direct communications with ATC. In the event there is no FSS and air/ground communications with ATC is not possible below a certain altitude, the pilot should, weather conditions permitting, cancel his IFR flight plan while still airborne and able to communicate with ATC by radio. This will not only save the time and expense of cancelling the flight plan by telephone but will quickly release the airspace for use by other aircraft.

305. GENERAL INSTRUCTIONS FOR THE FAA FLIGHT PLAN FORM

a. Flight Plan Form.



Form Approved: OMB No. 04-R0072

FLIGHT PLAN

CIVIL AIRCRAFT PILOTS.

VFR

IFR

DVFR

KTS

CLOSE VFR FLIGHT PLAN WITH ______________ FSS ON ARRIVAL

FAA Form 7233-1

b. Explanation of Flight Plan Items.

Block 1. Check the type flight plan. Check both the VFR and IFR blocks if composite VFR/IFR.

Block 2. Enter your complete aircraft identification including the prefix "N" if applicable.

Block 3. Enter the designator for the aircraft or, if unknown, the aircraft manufacturer's name (e.g., Cessna); followed by a slant(/) and the transponder or DME equipment code letter (e.g., C-182/U).

Block 4. Enter your computed true airspeed (TAS).

NOTE.— If IFR and the average TAS changes plus or minus 5 percent or 10 knots, whichever is greater, advise ATC.

Block 5. Enter the departure airport identifier code (or the name if identifier is unknown).

NOTE.— Use of identifier codes will expedite the processing of your flight plan.

Block 6. Enter the proposed departure time in Coordinated Universal Time (UTC) (Z). If airborne, specify the actual or proposed departure time as appropriate.

Block 7. If VFR, enter the appropriate VFR altitude (to assist the briefer in providing weather and wind information) and, if IFR, enter the requested en route altitude or flight level.

NOTE.— Enter only the initial requested altitude in this block. When more than one IFR altitude or flight level is desired along the route of flight, it is best to make a subsequent request direct to the controller.

Block 8. Define the route of flight by using NAVAID identifier codes (or names if the code is unknown), airways, jet routes, and waypoints (for RNAV).

NOTE.— Use NAVAIDs or WAYPOINTs to define direct routes and radials/bearings to define other unpublished routes.

Block 9. Enter the destination airport identifier code (or name if identifier is unknown).

NOTE.— Include the city name (or even the state name) if needed for clarity.

Block 10. Enter your estimated time en route based on latest forecast winds.

Block 11. Enter only those remarks pertinent to ATC or to the clarification of other flight plan information such as the appropriate radiotelephony (call sign) associated with the designator filed in Block 2. Items of a personal nature are not accepted. Do not assume that remarks will be automatically transmitted to every controller. Specific ATC or en route requests should be made directly to the appropriate controller.

Block 12. Specify the fuel on board computed from the departure point.

Block 13. Specify an alternate airport if desired or required, but do not include routing to the alternate airport.

Block 14. Enter your complete name, address, and telephone number. Enter sufficient information to identify home base, airport, or operator.

NOTE.— This information would be essential in the event of search and rescue operation.

Block 15. Enter the total number of persons on board including crew.

Block 16. Enter the predominant colors.

Last Block. For VFR flight plans, record the FSS name for closing the flight plan. If the flight plan is closed with a different FSS or facility, state the recorded FSS name that would normally have closed your flight plan.

NOTE.— Close IFR flight plans with tower, approach control, or ARTCCs, or if unable, with FSS. When landing at an airport with a functioning control tower, IFR flight plans are automatically cancelled.

c. The information transmitted to the destination FSS for VFR Flight Plans will consist only of flight plans blocks 2,3,9, and 10. Estimated time en route (ETE) will be converted to the correct estimated time of arrival (ETA) for VFR flight plans.

d. The information transmitted to the ARTCC for IFR Flight Plans will consist of only flight plan blocks 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11.

e. A description of the International Flight Plan Form is contained in the International Flight Information Manual.

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NOTES

Section 6. DEPARTURE PROCEDURES

320. PRE-TAXI CLEARANCE PROCEDURES

a. Certain airports have established Pre-taxi Clearance programs whereby pilots of departing IFR aircraft may elect to receive their IFR clearances before they start taxiing for takeoff. The following provisions are included in such procedures:

(1) Pilot participation is not mandatory.

(2) Participating pilots call clearance delivery or ground control not more than 10 minutes before proposed taxi time.

(3) IFR clearance (or delay information, if clearance cannot be obtained) is issued at the time of this initial call-up.

(4) When the IFR clearance is received on clearance delivery frequency, pilots call ground control when ready to taxi.

(5) Normally, pilots need not inform ground control that they have received IFR clearance on clearance delivery frequency. Certain locations may, however, require that the pilot inform ground control of a portion of his routing or that he has received his IFR clearance.

(6) If a pilot cannot establish contact on clearance delivery frequency or has not received his IFR clearance before he is ready to taxi, he contacts ground control and informs the controller accordingly.

b. Locations where these procedures are in effect are indicated in the Airport/Facility Directory.

321. TAXI CLEARANCE

Pilots on IFR flight plans should communicate with the control tower on the appropriate ground control or clearance delivery frequency, prior to starting engines, to receive engine start time, taxi and/or clearance information.

322. ABBREVIATED IFR DEPARTURE CLEARANCE (CLEARED...AS FILED) PROCEDURES

a. ATC facilities will issue an abbreviated IFR departure clearance based on the ROUTE of flight filed in the IFR flight plan, provided the filed route can be approved with little or no revision. These abbreviated clearance procedures are based on the following conditions:

(1) The aircraft is on the ground or it has departed VFR and the pilot is requesting IFR clearance while airborne.

(2) That a pilot will not accept an abbreviated clearance if the route or destination of a flight plan filed with ATC has been changed by him or the company or the operations officer before departure.

(3) That it is the responsibility of the company or operations office to inform the pilot when they make a change to the filed flight plan.

(4) That it is the responsibility of the pilot to inform ATC in his initial call-up (for clearance) when the filed flight plan has been either:

(a) amended, or

(b) cancelled and replaced with a new filed flight plan.

NOTE.— The facility issuing a clearance may not have received the revised route or the revised flight plan by the time a pilot requests clearance.

b. The controller will issue a detailed clearance when he knows that the original filed flight plan has been changed or when the pilot requests a full route clearance.

c. The clearance as issued will include the destination airport filed in the flight plan.

d. ATC procedures now require the controller to state the SID name, the current number and the SID Transition name after the phrase "Cleared to (destination) airport" and prior to the phrase, "then as filed," for ALL departure clearances when the SID or SID Transition is to be flown. The procedures apply whether or not the SID is filed in the flight plan.

e. STARs, when filed in a flight plan, are considered a part of the filed route of flight and will not normally be stated in an initial departure clearance. If the ARTCC's jurisdictional airspace includes both the departure airport and the fix where a STAR or STAR Transition begins, the STAR name, the current number and the STAR Transition name MAY be stated in the initial clearance.

f. "Cleared to (destination) airport as filed" does NOT include the en route altitude filed in a flight plan. An en route altitude will be stated in the clearance or the pilot will be advised to expect an assigned or filed altitude within a given time frame or at a certain point after departure. This may be done verbally in the departure instructions or stated in the SID.

g. In both radar and nonradar environments, the controller will state "Cleared to (destination) airport as filed" or:

(1) If a SID or SID Transition is to be flown, specify the SID name, the current SID number, the SID Transition name, the assigned altitude/flight level, and any additional instructions (departure control frequency, beacon code assignment, etc.) necessary to clear a departing aircraft via the SID or SID Transition and the route filed.

EXAMPLE:

NATIONAL SEVEN TWENTY CLEARED TO MIAMI AIRPORT INTERCONTINENTAL ONE DEPARTURE, LAKE CHARLES TRANSITION THEN AS FILED, MAINTAIN FLIGHT LEVEL TWO SEVEN ZERO.

(2) When there is no SID or when the pilot cannot accept a SID, the controller will specify the assigned altitude or flight level, and any additional instructions necessary to clear a departing aircraft via an appropriate departure routing and the route filed.

NOTE.— A detailed departure route description or a radar vector may be used to achieve the desired departure routing.

(3) If it is necessary to make a minor revision to the filed route, the controller will specify the assigned SID or SID Transition (or departure routing), the revision to the filed route, the assigned altitude or flight level and any additional instructions necessary to clear a departing aircraft.

EXAMPLE:

JET STAR ONE FOUR TWO FOUR CLEARED TO ATLANTA AIRPORT, SOUTH BOSTON TWO DEPARTURE THEN AS FILED EXCEPT CHANGE ROUTE TO READ SOUTH BOSTON VICTOR 20 GREENSBORO, MAINTAIN ONE SEVEN THOUSAND.

(4) Additionally, in a nonradar environment, the controller will specify one or more fixes, as necessary, to identify the initial route of flight.

EXAMPLE:

CESSNA THREE ONE SIX ZERO FOXTROT CLEARED TO CHARLOTTE AIRPORT AS FILED VIA BROOKE, MAINTAIN SEVEN THOUSAND.

h. To ensure success of the program, pilots should:

(1) Avoid making changes to a filed flight plan just prior to departure.

(2) State the following information in the initial call-up to the facility when no change has been made to the filed flight plan: Aircraft call sign, location, type operation (IFR) and the name of the airport (or fix) to which you expect clearance.

EXAMPLE:

"WASHINGTON CLEARANCE DELIVERY (or ground control if appropriate) AMERICAN SEVENTY SIX AT GATE ONE, IFR LOS ANGELES."

(3) If the flight plan has been changed, state the change and request a full route clearance.

EXAMPLE:

"WASHINGTON CLEARANCE DELIVERY, AMERICAN SEVENTY SIX AT GATE ONE. IFR SAN FRANCISCO. MY FLIGHT PLAN ROUTE HAS BEEN AMENDED (or destination changed). REQUEST FULL ROUTE CLEARANCE."

(4) Request verification or clarification from ATC if ANY portion of the clearance is not clearly understood.

(5) When requesting clearance for the IFR portion of a VFR/IFR flight, request such clearance prior to the fix where IFR operation is proposed to commence in sufficient time to avoid delay. Use the following phraseology:

EXAMPLE:

"LOS ANGELES CENTER, APACHE SIX ONE PAPA, VFR ESTIMATING PASO ROBLES VOR AT THREE TWO, ONE THOUSAND FIVE HUNDRED, REQUEST IFR TO BAKERSFIELD."

323. DEPARTURE RESTRICTIONS, CLEARANCE VOID TIMES, HOLD FOR RELEASE, AND RELEASE TIMES

a. ATC may assign departure restrictions, clearance void times, hold for release, and release times, when necessary, to separate departures from other traffic or to restrict or regulate the departure flow.

(1) CLEARANCE VOID TIMES — If operating from an airport not served by a control tower, the pilot may receive a clearance containing a provision that if the flight has not departed by a specific time, the clearance is void. In this situation, the pilot who does not depart prior to the void time must advise ATC as soon as possible, but no later than 30 minutes, of his intentions. Failure to take this action can result in costly delays and reroutes of other IFR traffic because ATC will take action on the assumption that the pilot departed as cleared. Additionally, extensive search and rescue operations may be initiated if nothing is heard from the pilot after he accepts the ATC clearance.

EXAMPLE:

CLEARANCE VOID IF NOT OFF BY (clearance void time) and, if required, IF NOT OFF BY (clearance void time) ADVISE (facility) NOT LATER THAN (time) OF INTENTIONS.

(2) HOLD FOR RELEASE — ATC may issue "hold for release" instructions in a clearance to delay an aircraft's departure for traffic management reasons (i.e. weather, traffic volume, etc.). When ATC states in the clearance, "hold for release," the pilot may not depart until he receives a release time or is given additional instructions by ATC. In addition, ATC will include departure delay information in conjunction with "hold for release" instructions.

EXAMPLE:

(aircraft identification) CLEARED TO (destination AIRPORT AS FILED, MAINTAIN (altitude), and, if required (additional instructions or information), HOLD FOR RELEASE, EXPECT (time in hours and/or minutes) DEPARTURE DELAY.

(3) RELEASE TIMES — A "release time" is a departure restriction issued to a pilot by ATC, specifying the earliest time an aircraft may depart. ATC will use "release times" in conjunction with traffic management procedures and/or to separate a departing aircraft from other traffic

EXAMPLE:

(aircraft identification) RELEASED FOR DEPARTURE AT (time in hours and/or minutes).

324. DEPARTURE CONTROL

a. Departure Control is an approach control function responsible for ensuring separation between departures. So as to expedite the handling of departures, Departure Control may suggest a take off direction other than that which may normally have been used under VFR handling. Many times it is preferred to offer the pilot a runway that will require the fewest turns after take off to place the pilot on his filed course or selected departure route as quickly as possible. At many locations particular attention is paid to the use of preferential runways for local noise abatement programs, and route departures away from congested areas.

b. Departure Control utilizing radar will normally clear aircraft out of the terminal area using SIDs via radio navigation aids. When a departure is to be vectored immediately following take off, the pilot will be advised prior to take off of the initial heading to be flown but may not be advised of the purpose of the heading. Pilots operating in a radar environment are expected to associate departure headings with vectors to their planned route or flight. When given a vector taking his aircraft off a previously assigned nonradar route, the pilot will be advised briefly what the vector is to achieve. Thereafter, radar service will be provided until the aircraft has been reestablished "on-course" using an appropriate navigation aid and the pilot has been advised of his position or a handoff is made to another radar controller with further surveillance capabilities.

c. Controllers will inform pilots of the departure control frequencies and, if appropriate, the transponder code before takeoff. Pilots should not operate their transponder until ready to start the takeoff roll or change to the departure control frequency until requested. Controllers may omit the departure control frequency if a SID has or will be assigned and the departure control frequency is published on the SID.

325. INSTRUMENT DEPARTURES

a. STANDARD INSTRUMENT DEPARTURES (SID)

(1) A SID is an ATC coded departure procedure which has been established at certain airports to simplify clearance delivery procedures.

(2) Pilots of civil aircraft operating from locations where SID procedures are effective may expect ATC clearances containing a SID. Use of a SID requires pilot possession of at least the textual description of the SID procedures. Controllers may omit the departure control frequency if a SID clearance is issued and the departure control frequency is published on the SID. If the pilot does not possess a charted SID or a preprinted SID description or, for any other reason, does not wish to use a SID, he is expected to advise ATC. Notification may be accomplished by filing "NO SID" in the remarks section of the filed flight plan or by the less desirable method of verbally advising ATC.

(3) All effective SIDs are published in textual and graphic form by the National Ocean Service in East and West SID booklets.

(4) SID procedures will be depicted in one of two basic forms.

(a) **Pilot Navigation (Pilot NAV) SIDs:** are established where the pilot is primarily responsible for navigation on the SID route. They are established for airports when terrain and safety related factors indicate the necessity for a pilot NAV SID. Some pilot NAV SIDs may contain vector instructions which pilots are expected to comply with until instruction are received to resume normal navigation on the filed/assigned route or SID procedure.

(b) **Vector SIDs:** are established where ATC will provide radar navigational guidance to a filed/assigned route or to a fix depicted on the SID.

b. OBSTRUCTION CLEARANCE DURING DEPARTURE

(1) Published instrument departure procedures and SIDs assist pilots conducting IFR flight in avoiding obstacles during climbout to minimum en route altitude (MEA). These procedures are established only at locations where instrument approach procedures are published. Standard instrument takeoff minimums and departure procedures are prescribed in FAR 91.116. Airports with takeoff minimums other than standard (one statute mile for aircraft having two engines or less and one-half statute mile for aircraft having more than two engines) are described in airport listings on separate pages titled IFR TAKE-OFF MINIMUMS AND DEPARTURE PROCEDURES, at the front of each U.S. Government published IAP and SID book. The approach chart and SID chart for each airport where takeoff minimums are not standard and/or departure procedures are published is annotated with a special symbol ▽. The use of this symbol indicates that the separate listing should be consulted. These minimums also apply to SIDs unless the SIDs specify different minimums.

(2) Obstacle clearance is based on the aircraft climbing at least 200 feet per nautical mile, crossing the end of the runway at least 35 feet AGL, and climbing to 400 feet above airport elevation before turning, unless otherwise specified in the procedure. A slope of 152 feet per nautical mile, starting no higher than 35 feet above the departure end of the runway, is assessed for obstacles. A minimum obstacle clearance of 48 feet per nautical mile is provided in the assumed climb gradient.

(a) If no obstacles penetrate the 152 feet per nautical mile slope, IFR departure procedures are not published.

(b) If obstacles do penetrate the slope, avoidance procedures are specified. These procedures may be: a ceiling and visibility to allow the obstacles to be seen and avoided; a climb gradient greater than 200 feet per nautical mile; detailed flight maneuvers; or a combination of the above. In extreme cases, IFR takeoff may not be authorized for some runways.

EXAMPLE:

Rwy 17, 300-1 or standard with minimum climb of 220 feet per NM to 1100.

(3) Climb gradients are specified when required for obstacle clearance. Crossing restrictions in the SIDs may be established for traffic separation or obstacle clearance. When no gradient is specified, the pilot is expected to climb at least 200 feet per nautical mile to MEA unless required to level off by a crossing restriction.

EXAMPLE:

"CROSS ALPHA INTERSECTION AT OR BELOW 4000; MAINTAIN 6000." The pilot climbs at least 200 feet per nautical mile to 6000. If 4000 is reached before ALPHA, the pilot levels off at 4000 until passing ALPHA; then immediately resumes at least 200 feet per nautical mile climb.

(4) Climb gradients may be specified to an altitude/fix, above which the normal gradient applies.

EXAMBLE;

"MINIMUM CLIMB 340 FEET PER NM TO 2700." The pilot climbs at least 340 feet per nautical mile to 2700, then at least 200 feet per NM to MEA.

(5) Some IFR departure procedures require a climb in visual conditions to cross the airport (or an on-airport NAVAID) in a specified direction, at or above a specified altitude.

EXAMBLE:

"CLIMB IN VISUAL CONDITIONS SO AS TO CROSS THE McELORY AIRPORT SOUTHBOUND, AT OR

ABOVE 6000, THEN CLIMB VIA KEEMMLING R-033 TO KEEMMLING VORTAC."

(a) When climbing in visual conditions it is the pilot's responsibility to see and avoid obstacles. Specified ceiling and visibility minimums will allow visual avoidance of obstacles until the pilot enters the standard obstacle protection area. Obstacle avoidance is not quaranteed if the pilot manuvers farther from the airport than the visibility minimum.

(b) That segment of the procedure which requires the pilot to see and avoid obstacles ends when the aircraft crosses the specified point at the required altitude. Thereafter, standard obstacle protection is provided.

(6) Each pilot, prior to departing an airport on an IFR flight should consider the type of terrain and other obstacles on or in the vicinity of the departure airport and

(a) Determine whether a departure procedure and/or SID is available for obstacle avoidance.

(b) Determine if obstacle avoidance can be maintained visually or that the departure procedure or SID should be followed.

(c) Determine what action will be necessary and take such action that will assure a safe departure.

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Section 7. EN ROUTE PROCEDURES

340. ARTCC COMMUNICATIONS

a. DIRECT COMMUNICATIONS — CONTROLLERS AND PILOTS

(1) ARTCCs are capable of direct communications with IFR air traffic on certain frequencies. Maximum communications coverage is possible through the use of Remote Center Air/Ground (RCAG) sites comprised of both VHF and UHF transmitters and receivers. These sites are located throughout the U.S.. Although they may be several hundred miles away from the ARTCC, they are remoted to the various ARTCCs by land lines or microwave links. Since IFR operations are expedited through the use of direct communications, pilots are requested to use these frequencies strictly for communications pertinent to the control of IFR aircraft. Flight plan filing, en route weather, weather forecasts and similar data should be requested through FSSs, company radio, or appropriate military facilities capable of performing these services.

(2) An ARTCC is divided into sectors. Each sector is handled by one or a team of controllers and has its own sector discrete frequency. As a flight progresses from one sector to another, the pilot is requested to change to the appropriate sector discrete frequency.

(3) ATC Frequency Change Procedures:

(a) The following phraseology will be used by controllers to effect a frequency change:

EXAMPLE:

(Aircraft Identification) CONTACT (facility name or location name and terminal function) (frequency) AT (time, fix or altitude).

NOTE.— Pilots are expected to maintain a listening watch on the transferring controller's frequency until the time, fix or altitude specified. ATC will omit frequency change restrictions whenever pilot compliance is expected upon receipt.

(b) The following phraseology should be utilized by pilots for establishing contact with the designated facility:

1. When a position report will be made:

EXAMPLE:

(Name) CENTER, (aircraft identification), (position).

2. When no position report will be made:

EXAMPLE:

(Name) CENTER, (aircraft identification), ESTIMATING (reporting point and time) AT (altitude or flight level) CLIMBING (or descending) TO MAINTAIN (altitude or flight level).

3. When operating in a radar environment and no position report is required:

EXAMPLE:

(Name) CENTER, (aircraft identification) AT (exact altitude or flight level); or, if appropriate,

EXAMPLE:

LEAVING (exact altitude or flight level) CLIMBING (or descending) TO MAINTAIN (altitude or flight level).

NOTE.— Exact altitude or flight level means to the nearest 100 foot increment. Exact altitude or flight level reports on initial contact provide ATC with information required prior to using MODE C altitude information for separation purposes.

(c) At times controllers will ask pilots to verify that they are at a particular altitude. The phraseology used will be: "VERIFY AT (altitude)." In climbing or descending situations, controllers may ask pilots to "VERIFY ASSIGNED ALTITUDE AS (altitude)." Pilots should confirm that they are at the altitude stated by the controller or that the assigned altitude is correct as stated. If this is not the case, they should inform the controller of the actual altitude being maintained or the different assigned altitude.

CAUTION: Pilots should not take action to change their actual altitude or different assigned altitude to the altitude stated in the controllers verification request unless the controller specifically authorizes a change.

(4) ARTCC Radio Frequency Outage:

(a) ARTCCs normally have at least one back up radio receiver and transmitter system for each frequency which can usually be placed into service quickly with little or no disruption of ATC service. Occasionally, technical problems may cause a delay but switchover seldom takes more than 60 seconds. When it appears that the outage will not be quickly remedied, the ARTCC will usually request a nearby aircraft, if there is one, to switch to the affected frequency to broadcast communications instructions. It is important, therefore, that the pilot wait at least 1 minute before deciding that the ARTCC has actually experienced a radio frequency failure. When such an outage does occur, the pilot should, if workload and equipment capability permit, maintain a listening watch on the affected frequency while attempting to comply with the following recommended communications procedures:

1. If two-way communications cannot be established with the ARTCC after changing frequencies, a pilot should attempt to recontact the transferring controller for the assignment of an alternative frequency or other instructions.

2. When an ARTCC radio frequency failure occurs after two-way communications have been established, the pilot should attempt to reestablish contact with the center on any other known ARTCC frequency, preferably that of the next responsible sector when practicable, and ask for instructions. However, when the next normal frequency change along the route is known to involve another ATC facility, the pilot should contact that facility, if feasible, for instructions. If communications cannot be reestablished by either method, the pilot is expected to request communications instructions from the FSS appropriate to the route of flight.

NOTE.— The exchange of information between an aircraft and an ARTCC through an FSS is quicker than relay via company radio because the FSS has direct interphone lines to the responsible ARTCC sector. Accordingly, when circumstances dictate a

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choice between the two, during an ARTCC frequency outage, relay via FSS radio is recommended.

341. POSITION REPORTING

The safety and effectiveness of traffic control depends to a large extent on accurate position reporting. In order to provide the proper separation and expedite aircraft movements, ATC must be able to make accurate estimates of the progress of every aircraft operating on an IFR flight plan.

a. POSITION IDENTIFICATION

(1) When a position report is to be made passing a VOR radio facility, the time reported should be the time at which the first complete reversal of the "to/from" indicator is accomplished.

(2) When a position report is made passing a facility by means of an airborne ADF, the time reported should be the time at which the indicator makes a complete reversal.

(3) When an aural or a light panel indication is used to determine the time passing a reporting point, such as a fan marker, Z marker, cone of silence or intersection of range courses, the time should be noted when the signal is first received and again when it ceases. The mean of these two times should then be taken as the actual time over the fix.

(4) If a position is given with respect to distance and direction from a reporting point, the distance and direction should be computed as accurately as possible.

(5) Except for terminal area transition purposes, position reports or navigation with reference to aids not established for use in the structure in which flight is being conducted will not normally be required by ATC.

b. POSITION REPORTING POINTS

(1) FARs require pilots to maintain a listening watch on the appropriate frequency and, unless operating under the provisions of (c), to furnish position reports passing certain reporting points. Reporting points are indicated by symbols on en route charts. The designated compulsory reporting point symbol is a solid triangle and the "on request" reporting point symbol is the open triangle. Reports passing an "on request" reporting point are only necessary when requested by ATC.

c. POSITION REPORTING REQUIREMENTS

(1) **Flights along airways or routes** — A position report is required by all flights regardless of altitude, including those operating in accordance with an ATC clearance specifying "VFR ON TOP," over each designated compulsory reporting point along the route being flown.

(2) **Flight Along a Direct Route** — Regardless of the altitude or flight level being flown, including flights operating in accordance with an ATC clearance specifying "VFR ON TOP", pilots shall report over each reporting point used in the flight plan to define the route of flight.

(3) **Flights in a Radar Environment** — When informed by ATC that their aircraft are in "RADAR CONTACT," PILOTS SHOULD DISCONTINUE POSITION REPORTS OVER DESIGNATED REPORTING POINTS. They should resume normal position reporting when ATC advises "RADAR CONTACT LOST" or "RADAR SERVICE TERMINATED."

NOTE.— ATC will inform a pilot that he is in "RADAR CON TACT" (a) when his aircraft is initially identified in the AT system; and (b) when radar identification is reestablished af radar service has been terminated or radar contact lost. Sub quent to being advised that the controller has established rad contact, this fact will not be repeated to the pilot when handed to another controller. At times, the aircraft identity will be co *firmed* by the receiving controller; however, this should not be co strued to mean that radar contact has been lost. The identity transponder equipped aircraft will be confirmed by asking th pilot to "IDENT," "SQUAWK STANDBY," or to change code Aircraft without transponders will be advised of their positio confirm identity. In this case, *the pilot is expected to advise th controller if he disagrees with the position given.* If the p cannot confirm the accuracy of the position given because he not tuned to the NAVAID referenced by the controller, the p should ask for another radar position relative to the NAVAID which he is tuned.

d. POSITION REPORT ITEMS

(1) Position reports should include the follow items:

(a) Identification.

(b) Position.

(c) Time.

(d) Altitude or flight level (include actual altitu or flight level when operating on a clearance specifyi VFR ON TOP.)

(e) Type of flight plan (not required in IFR po tion reports made directly to ARTCCs or approach contr

(f) ETA and name of next reporting point.

(g) The name only of the next succeeding rep ing point along the route of flight, and

(h) Pertinent remarks.

342. ADDITIONAL REPORTS

a. The following reports should be made to ATC or FS facilities without a specific ATC request:

(1) *At all times:*

(a) When vacating any previously assigned al tude or flight level for a newly assigned altitude or flig level.

(b) When an altitude change will be made if ope ating on a clearance specifying VFR ON TOP.

(c) When *unable* to climb/descend at a rate of least 500 feet per minute.

(d) When approach has been missed. (Reque clearance for specific action; i.e., to alternative airport, other approach, etc.)

(e) Change in the average true airspeed (at cru ing altitude) when it varies by 5 percent or 10 kno (whichever is greater) from that filed in the flight plan.

(f) The time and altitude or flight level upon reac ing a holding fix or point to which cleared.

(g) When leaving any assigned holding fix o point.

NOTE.— The reports in subparagraphs (f) and (g) may be om ted by pilots of aircraft involved in instrument training at militar terminal area facilities when radar service is being provided.

(h) Any loss, in controlled airspace, of VO TACAN, ADF, low frequency navigation receiver capabi ity, complete or partial loss of ILS receiver capability or impairment of air/ground communications capability.

(l) Any information relating to the safety of flight.

(2) *When not in radar contact:*

(a) When leaving final approach fix inbound on final approach (non precision approach) or when leaving the outer marker or fix used in lieu of the outer marker inbound on final approach (precision approach).

(b) A corrected estimate at anytime it becomes apparent that an estimate as previously submitted is in error in excess of 3 minutes.

b. Pilots encountering weather conditions which have not been forecast, or hazardous conditions which have been forecast, are expected to forward a report of such weather to ATC. (See PARA—520 - PILOT WEATHER REPORTS (PIREPs) and FAR—91.125(b) and (c).)

343. AIRWAYS AND ROUTE SYSTEMS

a. Two fixed route systems are established for air navigation purposes. They are the VOR and L/MF system, and the jet route system. To the extent possible, these route systems are aligned in an overlying manner to facilitate transition between each.

(1) The VOR and L/MF Airway System consists of airways designated from 1,200 feet above the surface (or in some instances higher) up to but not including 18,000 feet MSL. These airways are depicted on En Route Low Altitude Charts.

(a) THE VOR AIRWAYS are predicated solely on VOR or VORTAC navigation aids, except in Alaska, and are depicted in blue on aeronautical charts and are identified by a "V" (Victor) followed by the airway number (e.g., V12).

NOTE.— Segments of VOR airways in Alaska are based on L/MF navigation aids and charted in brown color instead of blue on en route charts.

1. A segment of an airway which is common to two or more routes carries the numbers of all the airways which coincide for that segment. When such is the case, a pilot filing a flight plan needs to indicate only that airway number of the route which he is using.

2. *Alternate Airways* are identified by their location with respect to the associated main airway. "Victor 9 West" indicates an alternate airway associated with, and lying to the west of Victor 9.

NOTE.— A pilot who intends to make an airway flight, using VOR facilities, will simply specify the appropriate "Victor" airway(s) in his flight plan. For example, if a flight is to be made from Chicago to New Orleans at 8,000 feet, using omniranges only, the route may be indicated as "Departing from Chicago-Midway, cruising 8,000 feet via Victor 9 to Moisant International." If flight is to be conducted in part by means of L/MF navigation aids and in part on omniranges, specifications of the appropriate airways in the flight plan will indicate which types of facilities will be used along the described routes, and, for IFR flight, permit ATC to issue a traffic clearance accordingly. A route may also be described by specifying the station over which the flight will pass, but in this case since many VOR's and L/MF aids have the same name, the pilot must be careful to indicate which aid will be used at a particular location. This will be indicated in the route of flight portion of the flight plan by specifying the type of facility to be used after the location name in the following manner: Newark L/MF, Allentown VOR.

3. With respect to position reporting, reporting points are designated for VOR Airway Systems. Flights using Victor Airways will report over these points unless advised otherwise by ATC.

(b) THE L/MF AIRWAYS (colored airways) are predicated solely on L/MF navigation aids and are depicted in brown on aeronautical charts and are identified by color name and number (e.g., Amber One). Green and Red airways are plotted east and west. Amber and Blue airways are plotted north and south.

NOTE.— The colored airway system exists only in the State of Alaska. All such airways formerly designated within the conterminous U.S. have been rescinded.

(2) THE JET ROUTE SYSTEM consists of jet routes established from 18,000 feet MSL to FL 450 inclusive.

(a) These routes are depicted on En Route High Altitude Charts. Jet routes are depicted in blue on aeronautical charts and are identified by a "J" (Jet) followed by the airway number (e.g., J 12). Jet routes, as VOR airways, are predicated solely on VOR or VORTAC navigation facilities (except in Alaska).

NOTE.— Segments of jet routes in Alaska are based on L/MF navigation aids and are charted in brown color instead of blue on en route charts.

(b) With respect to position reporting, reporting points are designated for Jet Route systems. Flights using Jet Routes will report over these points unless otherwise advised by ATC.

(3) AREA NAVIGATION (RNAV) ROUTES

(a) RNAV is a method of navigation that permits aircraft operations on any desired course within the coverage of station referenced navigation signals or within the limits of a self-contained system capability or combination of these.

(b) Fixed RNAV routes are permanent, published routes which can be flight planned for use by aircraft with RNAV capability. A previously established fixed RNAV route system has been terminated except for a few high altitude routes in Alaska.

(c) Random RNAV routes are direct routes, based on area navigation capability, between waypoints defined in terms of latitude/longitude coordinates, degree-distance fixes, or offsets from established routes/airways at a specified distance and direction. Radar monitoring by ATC is required on all random RNAV routes.

b. OPERATION ABOVE FL 450 may be conducted on a point-to-point basis. Navigational guidance is provided on an area basis utilizing those facilities depicted on the En Route High Altitude Charts.

c. **Radar Vectors.** Controllers may vector aircraft within controlled airspace for separation purposes, noise abatement considerations, when an operational advantage will be realized by the pilot or the controller, or when requested by the pilot. Vectors outside of controlled airspace will be provided only on pilot request. Pilots will be advised as to what the vector is to achieve when the vector is controller initiated and will take the aircraft off a previously assigned nonradar route. To the extent possible, aircraft operating on RNAV routes will be allowed to remain on their own navigation.

d. **Pilots are cautioned when flying in Canadian airspace, to review Canadian Air Regulations.**

(1) Special attention should be given to the parts which differ from U.S. FARs.

(a) The Canadian Airways CLASS B airspace restriction is an example. CLASS B airspace is all controlled low level airspace above 12,500 feet MSL or the MEA, whichever is higher, within which only IFR and controlled VFR flights are permitted. (Low level airspace means an airspace designated and defined as such in the *Designated Airspace Handbook.)*

(b) Regardless of the weather conditions or the height of the terrain, no person shall operate an aircraft under VFR conditions within CLASS B airspace except in accordance with a clearance for VFR flight issued by ATC.

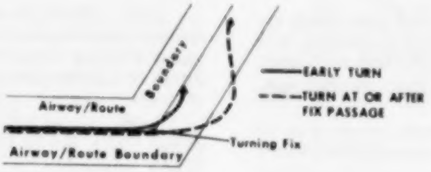
(c) Unless otherwise authorized by the Director General, Civil Aeronautics of the Department of Transportation, no person holding a commercial or private pilot license without an instrument rating shall operate an aircraft in VFR flight within CLASS B airspace unless successful completion of a written examination demonstrating knowledge of radio navigation and of ATC procedures applicable to IFR flight including clearances and position reports is accomplished. The pilot license must be endorsed to that effect.

(2) Segments of VOR airways and high level routes in Canada are based on L/MF navigation aids and are charted in brown color instead of blue on en route charts.

344. AIRWAY OR ROUTE COURSE CHANGES

a. Pilots of aircraft are required to adhere to airways or routes being flown. Special attention must be given to this requirement during course changes. Each course change consists of variables that make the technique applicable in each case a matter only the pilot can resolve. Some variables which must be considered are turn radius, wind effect, airspeed, degree of turn, and cockpit instrumentation. An early turn, as illustrated below, is one method of adhering to airways or routes. The use of any available cockpit instrumentation, such as distance measuring equipment, may be used by the pilot to lead his turn when making course changes. This *is consistent* with the intent of FAR—91.123, which requires pilots to operate along the centerline of an airway and along the direct course between navigational aids or fixes.

b. Turns which begin at or after fix passage may exceed airway or route boundaries. The following illustration contains an example flight track depicting this, together with an example of an early turn.



c. Without such actions as leading a turn, aircraft operating in excess of 290 knots TAS can exceed the normal airway or route boundaries depending on the amount of course change required, wind direction and velocity, the character of the turn fix (DME, overhead navigation aid, or intersection), and the pilot's technique in making a course change. For example, a flight operating at 17,000 feet MSL with a TAS of 400 knots, a 25 degree bank, and a course change of more than 40 degrees would exceed the width of the airway or route; i.e., 4 nautical miles each side of centerline. However, in the airspace below 18,000 feet MSL, operations in excess of 290 knots TAS are not prevalent and the provision of additional IFR separation in all course change situations for the occasional aircraft making a turn in excess of 290 knots TAS creates an unacceptable waste of airspace and imposes a penalty upon the preponderance of traffic which operate at low speeds. Consequently, the FAA expects pilots to lead turns and take other actions they consider necessary during course changes to adhere as closely as possible to the airways or route being flown.

d. Due to the high airspeeds used at 18,000 feet MSL and above, FAA provides additional IFR separation protection for course changes made at such altitude levels.

345. CHANGEOVER POINTS (COP)

a. COPs are prescribed for federal airways, jet routes, area navigation routes, or other direct routes for which an MEA is designated under FAR—95. The COP is a point along the route or airway segment between two adjacent navigation facilities or way points where changeover in navigation guidance should occur. At this point, the pilot should change navigation receiver frequency from the station behind the aircraft to the station ahead.

b. The COP is located midway between the navigation facilities for straight route segments, or at the intersection of radials or courses forming a dogleg in the case of dogleg route segments. When the COP is NOT located at the midway point, aeronautical charts will depict the COP location and give the mileage to the radio aids.

c. COPs are established for the purpose of preventing loss of navigation guidance, to prevent frequency interference from other facilities, and to prevent use of different facilities by different aircraft in the same airspace. Pilots are urged to observe COPs to the fullest extent.

346. RESERVED

347. HOLDING

a. Whenever an aircraft is cleared to a fix other than the destination airport and delay is expected, it is the responsibility of the ATC controller to issue complete holding instructions (unless the pattern is charted),* an EFC time and his best estimate of any additional en route/terminal delay.

b. If the holding pattern is charted and the controller doesn't issue complete holding instructions, the pilot is expected to hold as depicted on the appropriate chart. When the pattern is charted, the controller may omit all holding instructions except the charted holding direction and the statement *AS PUBLISHED* e.g., *HOLD EAST AS PUBLISHED*. Controllers shall always issue complete holding instructions when pilots request them.

NOTE.—* Only those holding patterns depicted on U.S. Government or commercially produced (meeting FAA requirements) *Low/High Altitude En route, and Area or STAR* charts should be used.

c. If no holding pattern is charted and holding instructions have not been issued, the pilot should ask ATC for holding instructions prior to reaching the fix. This procedure will eliminate the possibility of an aircraft entering a holding pattern other than that desired by ATC. If the pilot is unable to obtain holding instructions prior to reaching the fix (due to frequency congestion, stuck microphone, etc.), he should hold in a standard pattern on the course on which he approached the fix and request further clearance as soon as possible. In this event, the altitude/flight level of the aircraft at the clearance limit will be protected so that separation will be provided as required.

d. When an aircraft is 3 minutes or less from a clearance limit and a clearance beyond the fix has not been received, the pilot is expected to start a speed reduction so that he will cross the fix, initially, at or below the maximum holding airspeed.

e. When no delay is expected, the controller should issue a clearance beyond the fix as soon as possible and, whenever possible, at least 5 minutes before the aircraft reaches the clearance limit.

f. Pilots should report to ATC the time and altitude/flight level at which the aircraft reaches the clearance limit and report leaving the clearance limit.

NOTE.— In the event of two-way communications failure, pilots are required to comply with FAR 91.127.

g. When holding at a VOR station, pilots should begin the turn to the outbound leg at the time of the first complete reversal of the to/from indicator.

h. Patterns at the most generally used holding fixes are depicted (charted) on U.S. Government or commercially produced (meeting FAA requirements) Low or High Altitude En route, Area and STAR Charts. Pilots are expected to hold in the pattern depicted unless specifically advised otherwise by ATC.

i. An ATC clearance requiring an aircraft to hold at a fix where the pattern is not charted will include the following information:

(1) Direction of holding from the fix in terms of the eight cardinal compass points (i.e., N, NE, E, SE, etc.).

(2) Holding fix (the fix may be omitted if included at the beginning of the transmission as the clearance limit).

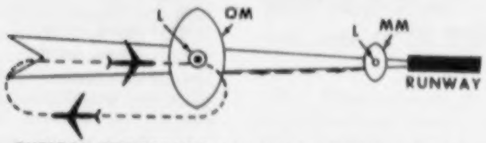
(3) Radial, course, bearing, airway or route on which the aircraft is to hold.

(4) Leg length in miles if DME or RNAV is to be used (leg length will be specified in minutes on pilot request or if the controller considers it necessary).

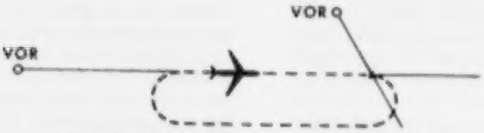
(5) Direction of turn if left turns are to be made, the pilot requests, or the controller considers it necessary.

(6) Time to expect further clearance and any pertinent additional delay information.

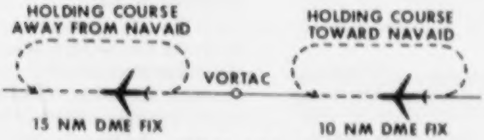
EXAMPLES OF HOLDING


L
OM
L
MM
RUNWAY

TYPICAL PROCEDURE ON AN ILS OUTER MARKER



TYPICAL PROCEDURE AT INTERSECTION
OF VOR RADIALS

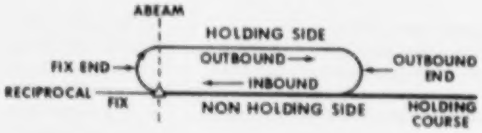

HOLDING COURSE
AWAY FROM NAVAID
HOLDING COURSE
TOWARD NAVAID
VORTAC
15 NM DME FIX
10 NM DME FIX

TYPICAL PROCEDURE AT DME FIX

j. Holding pattern airspace protection is based on the following procedures. They are the only procedures for entry and holding recommended by FAA.

(1) Descriptive Terms

(a) Standard Pattern : Right turns (illustrated)


ABEAM
HOLDING SIDE
FIX END
OUTBOUND
OUTBOUND END
INBOUND
RECIPROCAL
FIX
NON HOLDING SIDE
HOLDING COURSE

(b) Nonstandard Pattern : Left turns

(2) Airspeeds (maximum)

(a) Propeller-driven

1. All (including turboprop)........... 175K IAS

(b) Civil turbojet

1. MHA through 6,000 feet..............200K IAS

2. Above 6,000 feet through 14,000 feet..210K IAS

3. Above 14,000 feet..........................230K IAS

(c) Military turbojet

1. All-except aircraft listed below..230K I

2. F-84F, F-100, F-102, F-104, F-106, T-38, F-4, F-8, F-11, F-14, F-15, F-16, A-5, A-7 (USAF only), AV-8...265K I

3. F-4 (USAF only)............................280K I

4. F-100, F/RF-101, F-104, F-105, F-111, SR-71 .... 310K IAS

5. T-37 .... 175K IAS

NOTE.— Holding speed depends upon weight and drag configuration.

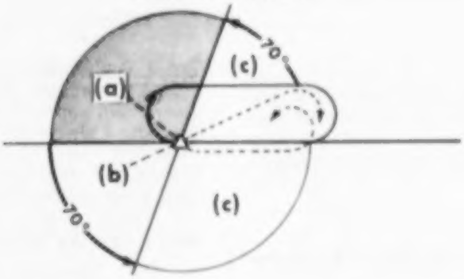
(3) **Entry**

(a) Parallel Procedure — Parallel holding course, turn left, and return to holding fix or intercept holding course.

(b) Teardrop Procedure — Proceed on outbound track of 30 degrees (or less) to holding course, turn right to intercept holding course.

(c) Direct Entry Procedure — Turn right and fly the pattern.

STANDARD PATTERN



(4) **Timing:**

(a) Inbound Leg

1. At/below 14,000 Ft. MSL - 1 minute.
2. Above 14,000 Ft. MSL - 1 and 1/2 minute.

NOTE.— The *initial* outbound leg should be flown for 1 minute or 1 and 1/2 min. (appropriate to altitude). Timing for subsequent outbound legs should be adjusted as necessary to achieve proper inbound leg time. Pilots may use any navigational means available (i.e. DME, RNAV, etc.) to insure the appropriate inbound leg times.

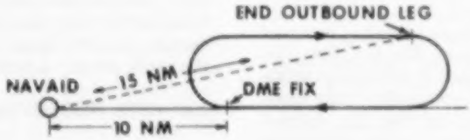
(b) Outbound leg timing begins *over / abeam* the fix, whichever occurs later. If the *abeam* position cannot be determined, start timing when turn to outbound is completed.

(5) **Distance Measuring Equipment (DME)**

(a) DME holding is subject to the same entry and holding procedures except that distances (nautical miles) are used in lieu of time values. The *outbound course* of a DME holding pattern is called the outbound leg of the pattern. The length of the outbound leg will be specified by the controller. The end of the outbound leg is determined by the odometer reading.

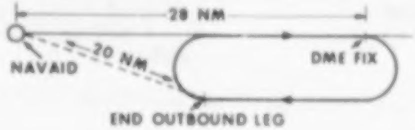
EXAMPLE:

When the inbound course is *toward* the NAVAID and the fix distance is 10 NM, and the leg length is 5NM, then the end of the outbound leg will be reached when the DME reads 15 NM.



EXAMPLE:

When the inbound course is *away* from the NAVAID and the fix distance is 28 NM and the leg length is 8 NM, then the end of the outbound leg will be reach when the DME reads 20 NM.



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(6) **Pilot Action**

(a) Start speed reduction when 3 minutes or less from the holding fix. Cross the holding fix, initially, at or below the maximum holding airspeed.

(b) Make all turns during entry and while holding at:

1. 3 degrees per second, or
2. 30 degree bank angle, or
3. 25 degree bank provided a flight director system is used.

NOTE.— Use whichever requires the least bank angle.

(c) Compensate for wind effect primarily by drift correction on the inbound and outbound legs. When outbound, double the (inbound) drift correction to avoid major turning adjustments; e.g., if correcting left by 8 degrees when inbound, correct right by 16 degrees when outbound.

(d) Determine entry turn from aircraft heading upon arrival at the holding fix. Plus/minus 5 degrees in heading is considered to be within allowable good operating limits for determining entry.

(e) Advise ATC immediately if any increased airspeed is necessary due to turbulence, icing, etc., or if unable to accomplish any part of the holding procedures. When such higher speeds become no longer necessary, operate according to the appropriate published holding speed and notify ATC.

NOTE.— Airspace protection for turbulent air holding is based on a maximum of 280K IAS/Mach 0.8, whichever is lower. Considerable impact on traffic flow will result when turbulent air holding patterns are used; thus, pilot discretion will ensure their use is limited to bona fide conditions or requirements.

(7) **Nonstandard Holding Pattern** — Fix end and outbound end turns are made to the left. Entry procedures to a nonstandard pattern are oriented in relation to the 70 degree line on the holding side just as in the standard pattern.

k. When holding at a fix and instructions are received specifying the time of departure from the fix, the pilot should adjust his flight path within the limits of the established holding pattern in order to leave the fix at the exact time specified. After departing the holding fix, normal speed is to be resumed with respect to other governing speed requirements such as terminal area speed limits, sp cific ATC requests, etc. Where the fix is associated with instrument approach, and timed approaches are in effect, procedure turn shall not be executed unless the pilot a vises ATC, since aircraft holding are expected to proce inbound on final approach directly from the holding pa tern when approach clearance is received.

l. RADAR SURVEILLANCE OF OUTER FIX HOL ING PATTERN AIRSPACE AREAS.

(1) Whenever aircraft are holding at an outer fi ATC will usually provide radar surveillance of the outer f holding pattern airspace area, or any portion of it, if it shown on the controller's radar scope.

(2) The controller will attempt to detect any holdi aircraft that stray outside the holding pattern airspa area and will assist any detected aircraft to return to t assigned airspace area.

NOTE.— Many factors could prevent ATC from providing t additional service, such as workload, number of targets, precipi tion, ground clutter, and radar system capability. These circu stances may make it unfeasible to maintain radar identification aircraft to detect aircraft straying from the holding pattern. Th provision of this service depends entirely upon whether the co troller believes he is in a position to provide it and does not relie a pilot of his responsibility to adhere to an accepted ATC cle ance.

(3) If an aircraft is established in a published hol ing pattern at an assigned altitude above the publishe minimum holding altitude and subsequently cleared for th approach, the pilot may descend to the published minimu holding altitude. The holding pattern would only be a se ment of the IAP *if* it is published on the instrument proc dure chart and is used in lieu of a procedure turn.

m. For those holding patterns where there are no pu lished minimum holding altitudes, the pilot, upon receivin an approach clearance, must maintain his last assigned a titude until leaving the holding pattern and established o the inbound course. Thereafter, the published minimum a titude of the route segment being flown will apply. It is e pected that the pilot will be assigned a holding altitud that will permit a normal descent on the inbound cours

348—359. RESERVED

Section 8. ARRIVAL PROCEDURES

360. STANDARD TERMINAL ARRIVAL (STAR)

a. A STAR is an ATC coded IFR arrival route established for application to arriving IFR aircraft destined for certain airports. Its purpose is to simplify clearance delivery procedures.

b. Pilots of IFR civil aircraft destined to locations for which STARs have been published may be issued a clearance containing a STAR whenever ATC deems it appropriate. Until military STAR publications and distribution is accomplished, STARs will be issued to military pilots only when requested in the flight plan or verbally by the pilot.

c. Use of STARs requires pilot possession of at least the approved textual description. As with any ATC clearance or portion thereof, it is the responsibility of each pilot to accept or refuse an issued STAR. A pilot should notify ATC if he does not wish to use a STAR by placing "NO STAR" in the remarks section of the flight plan or by the less desirable method of verbally stating the same to ATC.

d. A bound booklet containing all STAR charts is available on subscription from the National Ocean Service.

361. LOCAL FLOW TRAFFIC MANAGEMENT PROGRAM

a. This program is a continuing effort by the FAA to enhance safety, minimize the impact of aircraft noise and conserve aviation fuel. The enhancement of safety and reduction of noise is achieved in this program by minimizing low altitude maneuvering of arriving turbojet and turboprop aircraft weighing more than 12,500 pounds and, by permitting departure aircraft to climb to higher altitudes sooner, as arrivals are operating at higher altitudes at the points where their flight paths cross. The application of these procedures also reduces exposure time between controlled aircraft and uncontrolled aircraft at the lower altitudes in and around the terminal environment. Fuel conservation is accomplished by absorbing any necessary arrival delays for aircraft included in this program operating at the higher and more fuel efficient altitudes.

b. A fuel efficient descent is basically an uninterrupted descent (except where level flight is required for speed adjustment) from cruising altitude to the point when level flight is necessary for the pilot to stabilize his final approach. The procedure for a fuel efficient descent is based on an altitude loss which is most efficient for the majority of aircraft being served. This will generally result in a descent gradient window of 250-350 feet per nautical mile.

c. When crossing altitudes and speed restrictions are issued verbally or are depicted on a chart, ATC will expect the pilot to descend first to the crossing altitude and then reduce speed. Verbal clearances for descent will normally permit an uninterrupted descent in accordance with the procedure as described in paragraph b. above. Acceptance of a charted fuel efficient descent (Runway Profile Descent) clearance requires the pilot to adhere to the altitudes, speeds, and headings depicted on the charts unless otherwise instructed by ATC. PILOTS RECEIVING A CLEARANCE FOR A FUEL EFFICIENT DESCENT ARE EXPECTED TO ADVISE ATC IF THEY DO NOT HAVE RUNWAY PROFILE DESCENT CHARTS PUBLISHED FOR THAT AIRPORT OR ARE UNABLE TO COMPLY WITH THE CLEARANCE.

362. APPROACH CONTROL

a. Approach control is responsible for controlling all instrument flight operating within its area of responsibility. Approach control may serve one or more airfields, and control is exercised primarily by direct pilot and controller communications. Prior to arriving at the destination radio facility, instructions will be received from ARTCC to contact approach control on a specified frequency.

b. Radar Approach Control

(1) Where radar is approved for approach control service, it is used not only for radar approaches (ASR and PAR) but is also used to provide vectors in conjunction with published nonradar approaches based on radio NAVAIDs (ILS, MLS, VOR, NDB, TACAN). Radar vectors can provide course guidance and expedite traffic to the final approach course of any established IAP or to the traffic pattern for a visual approach. Approach control facilities that provide this radar service will operate in the following manner:

(a) Arriving aircraft are either cleared to an outer fix most appropriate to the route being flown with vertical separation and, if required, given holding information or, when radar handoffs are effected between the ARTCC and approach control, or between two approach control facilities, aircraft are cleared to the airport or to a fix so located that the handoff will be completed prior to the time the aircraft reaches the fix. When radar handoffs are utilized, successive arriving flights may be handed off to approach control with radar separation in lieu of vertical separation.

(b) After release to approach control, aircraft are vectored to the final approach course (ILS, MLS, VOR, ADF, etc.). Radar vectors and altitude or flight levels will be issued as required for spacing and separating aircraft. *Therefore, pilots must not deviate from the headings issued by approach control.* Aircraft will normally be informed when it is necessary to vector across the final approach course for spacing or other reasons. If approach course crossing is imminent and the pilot has not been informed that he will be vectored across the final approach course, he should query the controller.

(c) The pilot is not expected to turn inbound on the final approach course unless an approach clearance has been issued. This clearance will normally be issued with the final vector for interception of the final approach course, and the vector will be such as to enable the pilot to establish his aircraft on the final approach course prior to reaching the final approach fix.

(d) In the case of aircraft already inbound on the final approach course, approach clearance will be issued

prior to the aircraft reaching the final approach fix. When established inbound on the final approach course, radar separation will be maintained and the pilot will be expected to complete the approach utilizing the approach aid designated in the clearance (ILS, MLS, VOR, radio beacons, etc.) as the primary means of navigation. Therefore, once established on the final approach course, pilots must not deviate from it unless a clearance to do so is received from ATC.

(e) After passing the final approach fix on final approach, aircraft are expected to continue inbound on the final approach course and complete the approach or effect the missed approach procedure published for that airport.

(2) Whether aircraft are vectored to the appropriate final approach course or provide their own navigation on published routes to it, radar service is automatically terminated when the landing is completed or when instructed to change to advisory frequency at uncontrolled airports, whichever occurs first.

363. ADVANCE INFORMATION ON INSTRUMENT APPROACH

a. When landing at airports with approach control services and where two or more IAPs are published, pilots will be provided in advance of their arrival with the type of approach to expect or that they may be vectored for a visual approach. This information will be broadcast either by a controller or on ATIS. It will not be furnished when the visibility is three miles or better and the ceiling is at or above the highest initial approach altitude established for any low altitude IAP for the airport.

b. The purpose of this information is to aid the pilot in planning arrival actions; however, it is not an ATC clearance or commitment and is subject to change. Pilots should bear in mind that fluctuating weather, shifting winds, blocked runway, etc., are conditions which may result in changes to approach information previously received. It is important that the pilot advise ATC immediately if he is unable to execute the approach ATC advised will be used, or if he prefers another type of approach.

c. When making an IFR approach to an airport not served by a tower or FSS, after the ATC controller advises "CHANGE TO ADVISORY FREQUENCY APPROVED" you should broadcast your intentions, including the type of approach being executed, your position, and when over the final approach fix inbound (non precision approach) or when over the outer marker or fix used in lieu of the outer marker inbound (precision approach). Continue to monitor the appropriate frequency (UNICOM, etc.) for reports from other pilots.

364. INSTRUMENT APPROACH PROCEDURE CHARTS

a. FAR—91.116a (Instrument Approaches to Civil Airports) requires the use of SIAPs prescribed for the airport in Part 97 unless otherwise authorized by the Administrator (including ATC). FAR—91.116g (Military Airports) requires civil pilots flying into or out of military airports to comply with the IAPs and takeoff and landing minimums prescribed by the authority having jurisdiction at those airports.

(1) All IAPs (standard and special, civil and military) are based on joint civil and military criteria contained in the U.S. Standard for TERPs. The design of IAPs based on criteria contained in TERPs, takes into account the interrelationship between airports, facilities, and the surrounding environment, terrain, obstacles, noise sensitivity, etc. Appropriate altitudes, courses, headings, distances, and other limitations are specified and, once approved, the procedures are published and distributed by government and commercial cartographers as instrument approach charts.

(2) Not all IAPs are published in chart form. Radar IAPs are established where requirements and facilities exist but they are printed in tabular form in appropriate U.S. Government Flight Information Publications.

(3) A pilot adhering to the altitudes, flight paths, and weather minimums depicted on the IAP chart or vectors and altitudes issued by the radar controller, is assured of terrain and obstruction clearance and runway or airport alignment during approach for landing.

(4) IAPs are designed to provide an IFR descent from the en route environment to a point where a safe landing can be made. They are prescribed and approved by appropriate civil or military authority to ensure a safe descent during instrument flight conditions at a specific airport. It is important that pilots understand these procedures and their use prior to attempting to fly instrument approaches.

(5) TERPs criteria are provided for the following type of instrument approach procedures:

(a) Precision approaches where an electronic glide slope is provided (PAR and ILS) and,

(b) Nonprecision approaches where glide slope information is not provided (all approaches except PAR and ILS).

b. The method used to depict prescribed altitudes on instrument approach charts differs according to techniques employed by different chart publishers. Prescribed altitudes may be depicted in three different configurations: Minimum, maximum, and mandatory. The U.S. Government distributes charts produced by Defense Mapping Agency (DMA) and NOS. Altitudes are depicted on these charts in the profile view with underscore, overscore, or both to identify them as minimum, maximum, or mandatory.

(1) Minimum Altitude will be depicted with the altitude value underscored. Aircraft are required to maintain altitude at or above the depicted value.

(2) Maximum Altitude will be depicted with the altitude value overscored. Aircraft are required to maintain altitude at or below the depicted value.

(3) Mandatory Altitude will be depicted with the altitude value both underscored and overscored. Aircraft are required to maintain altitude at the depicted value.

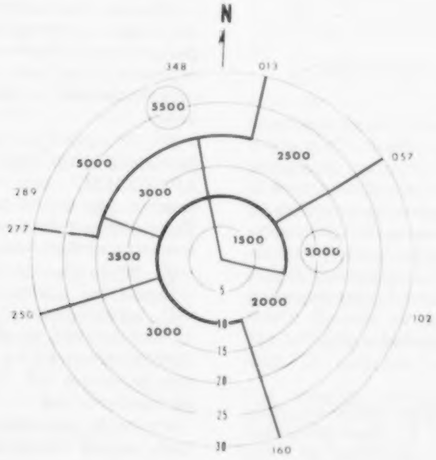
NOTE.— The underscore and overscore to identify mandatory altitudes and the overscore to identify maximum altitudes are used almost exclusively by DMA for military charts. With very few exceptions, civil approach charts produced by NOS utilize only the underscore to identify minimum altitudes. Pilots are cautioned to adhere to altitudes as prescribed because, in certain instances they may be used as the basis for vertical separation of aircraft by ATC. When a depicted altitude is specified in the ATC clearance that altitude becomes mandatory as defined above.

c. Minimum Safe Altitudes (MSA) are published for emergency use on approach procedure charts utilizing NDB or VOR type facilities. The altitude shown provides at least 1,000 feet of clearance above the highest obstacle in the defined sector to a distance of 25 NM from the facility. As many as four sectors may be depicted with different altitudes for each sector displayed in rectangular boxes in the plan view of the chart. A single altitude for the entire area may be shown in the lower right portion of the plan view. Navigational course guidance is not assured at the MSA within these sectors.

d. Minimum Vectoring Altitudes (MVA) are established for use by ATC when radar ATC is exercised. MVA charts are prepared by air traffic facilities at locations where there are numerous different minimum IFR altitudes. Each MVA chart has sectors large enough to accommodate vectoring of aircraft within the sector at the MVA. Each sector boundary is at least 3 miles from the obstruction determining the MVA. To avoid a large sector with an excessively high MVA due to an isolated prominent obstruction, the obstruction may be enclosed in a buffer area whose boundaries are at least 3 miles from the obstruction. This is done to facilitate vectoring around the obstruction.

(1) The minimum vectoring altitude in each sector provides 1,000 feet above the highest obstacle in nonmountainous areas and 2,000 feet above the highest obstacle in designated mountainous areas. Where lower MVAs are required in designated mountainous areas to achieve compatibility with terminal routes or to permit vectoring to an IAP, 1,000 feet of obstacle clearance may be authorized with the use of Airport Surveillance Radar (ASR). The minimum vectoring altitude will provide at least 300 feet above the floor of controlled airspace.

(2) Because of differences in the areas considered for MVA, and those applied to other minimum altitudes, and the ability to isolate specific obstacles, some MVAs may be lower than the nonradar Minimum En route Altitudes (MEA), Minimum Obstruction Clearance Altitudes (MOCA) or other minimum altitudes depicted on charts for a given location. While being radar vectored, IFR altitude assignments by ATC will be at or above MVA.



e. Visual Descent Points (VDP) are incorporated in selected nonprecision approach procedures. The VDP is a defined point on the final approach course of a nonprecision straight-in approach procedure from which normal descent from the MDA to the runway touchdown point may be commenced, provided visual reference required by FAR—91.116(c)(3) is established. The VDP will normally be identified by DME on VOR and LOC procedures. The VDP is identified on the profile view of the approach chart by the symbol: **V** .

(1) VDPs are intended to provide additional guidance where they are implemented. No special technique is required to fly a procedure with a VDP. The pilot should not descend below the MDA prior to reaching the VDP and acquiring the necessary visual reference in accordance with FAR—91.116(c)(3)(4).

(2) Pilots not equipped to receive the VDP should fly the approach procedure as though no VDP had been provided.

pages tightly bound

365. APPROACH CLEARANCE

a. An aircraft which has been cleared to a holding fix and subsequently "cleared . . . approach" has not received new routing. Even though the "cleared . . . approach" may have been issued or received prior to the aircraft reaching the holding fix, ATC would expect the pilot to proceed via the holding fix (his last assigned route), a transition if one exists, and then to the initial approach fix to commence his approach.

b. If a transition fix is located along the route of flight en route to the holding fix and clearance for an approach is received, he should commence his approach from the transition fix if not already passed it.

c. If a route of flight directly to the initial approach fix is desired, it should be so stated by the controller with phraseology to include the words "direct . . .," "proceed direct" or a similar phrase which the pilot can interpret without question. If the pilot is uncertain of his clearance, he should immediately query ATC as to what route of flight is desired.

366—369. RESERVED

370. INSTRUMENT APPROACH PROCEDURES

a. Minimums are specified for various aircraft approach categories based upon a value 1.3 times the stalling speed of the aircraft in the landing configuration at maximum certificated gross landing weight. (See FAR 97.3(b)). If it is necessary, while circling to land, to maneuver at speeds in excess of the upper limit of the speed range for each category, due to the possibility of extending the circling maneuver beyond the area for which obstruction clearance is provided, the circling minimum for the next higher approach category should be used. For example, an aircraft which falls in Category C, but is circling to land at a speed of 141 knots or higher should use the approach category "D" minimum when circling to land.

b. When operating on an unpublished route or while being radar vectored, the pilot, when an approach clearance is received, shall, in addition to complying with the minimum altitudes for IFR operations (FAR—91.119), maintain his last assigned altitude unless a different altitude is assigned by ATC, or until the aircraft is established on a segment of a published route or IAP. After the aircraft is so established, published altitudes apply to descent within each succeeding route or approach segment unless a different altitude is assigned by ATC. Notwithstanding this pilot responsibility, for aircraft operating on unpublished routes or while being radar vectored, ATC will, except when conducting a radar approach, issue an IFR approach clearance only after the aircraft is established on a segment of a published route or IAP, or assigned an altitude to maintain until the aircraft is established on a segment of a published route or instrument approach procedure. For this purpose, the procedure turn of a published IAP shall not be considered a segment of that IAP until the aircraft reaches the initial fix or navigation facility upon which the procedure turn is predicated.

EXAMPLE:

CROSS REDDING VOR AT OR ABOVE FIVE THOUSAND, CLEARED FOR VOR RUNWAY THREE FOUR APPROACH. *or*

EXAMPLE:

FIVE MILES FROM OUTER MARKER, TURN RIGHT HEADING THREE THREE ZERO. MAINTAIN TWO THOUSAND UNTIL ESTABLISHED ON THE LOCALIZER, CLEARED FOR ILS RUNWAY THREE SIX APPROACH.

NOTE.— The altitude assigned will assure IFR obstruction clearance from the point at which the approach clearance is issued until established on a segment of a published route or IAP. If a pilot is uncertain of the meaning of his clearance, he shall immediately request clarification from ATC.

c. Several IAPs, using various navigation and approach aids may be authorized for an airport. ATC may advise that a particular approach procedure is being used, primarily to expedite traffic. (See PARA—363 - ADVANCE INFORMATION ON INSTRUMENT APPROACH.) If a pilot is issued a clearance that specifies a particular approach procedure, he is expected to notify ATC immediately if he desires a different one. In this event it may be necessary for ATC to withhold clearance for the different approach until such time as traffic conditions permit. However, if the pilot is involved in an emergency situation he will be given priority. If the pilot is not familiar with the specific approach procedure, ATC should be advised and they will provide detailed information on the execution of the procedure.

d. At times ATC may not specify a particular approach procedure in the clearance, but will state "CLEARED FOR APPROACH." Such clearance indicates that the pilot may execute any one of the authorized IAPs for that airport. This clearance does not constitute approval for the pilot to execute a contact approach or a visual approach.

e. When cleared for a specifically prescribed IAP; i.e. "cleared for ILS runway one niner approach" or when "cleared for approach" i.e., execution of any procedure prescribed for the airport, pilots shall execute the entire procedure as described on the IAP Chart unless an appropriate new or revised ATC clearance is received, or the IFR flight plan is cancelled.

f. Pilots planning flights to locations served by special IAPs should obtain advance approval from the owner of the procedure. Approval by the owner is necessary because special procedures are for the exclusive use of the single interest unless otherwise authorized by the owner. Additionally, some special approach procedures require certain crew qualifications training, or other special considerations in order to execute the approach. Also, some of these approach procedures are based on privately owned navigational aids. Owners of aids that are not for public use may elect to turn off the aid for whatever reason they may have; i.e., maintenance, conservation, etc. Air traffic controllers are not required to question pilots to determine if they have permission to use the procedure. Controllers presume a pilot has obtained approval and is aware of any details of the procedure if he files an IFR flight plan to that airport.

g. When executing an instrument approach and in radio contact with an FAA facility, unless in "radar contact," report passing the final approach fix inbound (non precision approach) or the outer marker or fix used in lieu of the outer marker inbound (precision approach).

h. If a missed approach is required, advise ATC and include the reason (unless initiated by ATC). Comply with the missed approach instructions for the instrument approach procedure being executed, unless otherwise directed by ATC. (See PARA—382 - MISSED APPROACH and PARA—404 - MISSED APPROACH.)

371. PROCEDURE TURN

a. A procedure turn is the maneuver prescribed when it is necessary to reverse direction to establish the aircraft inbound on an intermediate or final approach course. It is a required maneuver except when the symbol NoPT is shown, when RADAR VECTORING is provided, when a holding pattern is published in lieu of procedure turn, or when the procedure turn is not authorized. The altitude prescribed for the procedure turn is a *minimum* altitude until the aircraft is established on the inbound course. The maneuver must be completed within the distance specified in the profile view.

(1) On U.S. Government charts, a barbed arrow indicates the direction or side of the outbound course on which the procedure turn is made. Headings are provided for course reversal using the 45 degree type procedure turn. However, the point at which the turn may be commenced and the type and rate of turn is left to the discretion of the pilot. Some of the options are the 45 degree procedure turn, the racetrack pattern, the tear-drop procedure turn, or the 80 degree - 260 degree course reversal. Some procedure turns are specified by procedural track. These turns must be flown exactly as depicted.

(2) When the approach procedure involves a procedure turn, a maximum speed of not greater than 250 knots (IAS) should be observed and the turn should be executed within the distance specified in the profile view. The normal procedure turn distance is 10 miles. This may be reduced to a minimum of 5 miles where only Category A or helicopter aircraft are to be operated or increased to as much as 15 miles to accommodate high performance aircraft.

(3) A teardrop procedure or penetration turn may be specified in some procedures for a required course reversal. The teardrop procedure consists of departure from an initial approach fix on an outbound course followed by a turn toward and intercepting the inbound course at or prior to the intermediate fix or point. Its purpose is to permit an aircraft to reverse direction and lose considerable altitude within reasonably limited airspace. Where no fix is available to mark the beginning of the intermediate segment, it shall be assumed to commence at a point 10 miles prior to the final approach fix. When the facility is located on the airport, an aircraft is considered to be on final approach upon completion of the penetration turn. However, the final approach segment begins on the final approach course 10 miles from the facility.

(4) A procedure turn need not be established when an approach can be made from a properly aligned holding pattern. In such cases, the holding pattern is established over an intermediate fix or a final approach fix. The holding pattern maneuver is completed when the aircraft is established on the inbound course after executing the appropriate entry. If cleared for the approach prior to returning to the holding fix, and the aircraft is at the prescribed altitude, additional circuits of the holding pattern are not necessary nor expected by ATC. If the pilot elects to make additional circuits to lose excessive altitude or to become better established on course, it is his responsibility to so advise ATC when he receives his approach clearance.

(5) A procedure turn is not required when an approach can be made directly from a specified intermediate fix to the final approach fix. In such cases, the term "NoPT" is used with the appropriate course and altitude to denote that the procedure turn is not required. If a procedure turn is desired, and when cleared to do so by ATC, descent below the procedure turn altitude should not be made until the aircraft is established on the inbound course, since some NoPT altitudes may be lower than the procedure turn altitudes.

b. Limitations on Procedure Turns.

(1) In the case of a radar initial approach to a final approach fix or position, or a timed approach from a holding fix, or where the procedure specifies "NoPT", no pilot may make a procedure turn unless, when he receives his final approach clearance, he so advises ATC and a clearance is received.

(2) When a teardrop procedure turn is depicted and a course reversal is required, this type turn must be executed.

(3) When holding pattern replaces the procedure turn, the standard entry and the holding pattern must be followed except when RADAR VECTORING is provided or when NoPT is shown on the approach course. As in the procedure turn, the descent from the minimum holding pattern altitude to the final approach fix altitude (when lower) may not commence until the aircraft is established on the inbound course.

(4) The absence of the procedure turn barb in the Plan View indicates that a procedure turn is not authorized for that procedure.

372. TIMED APPROACHES FROM A HOLDING FIX

a. TIMED APPROACHES may be conducted when the following conditions are met:

(1) A control tower is in operation at the airport where the approaches are conducted.

(2) Direct communications are maintained between the pilot and the center or approach controller until the pilot is instructed to contact the tower.

(3) If more than one missed approach procedure is available, none require a course reversal.

(4) If only one missed approach procedure is available, the following conditions are met:

(a) Course reversal is not required; and,

(b) Reported ceiling and visibility are equal to or greater than the highest prescribed circling minimums for the IAP.

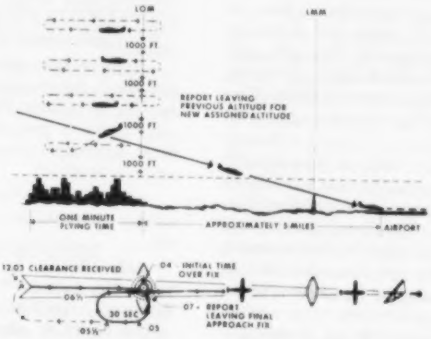
(5) When cleared for the approach, pilots shall not execute a procedure turn. (FAR—91.116(h).)

b. Although the controller will not specifically state that "timed approaches are in progress", his assigning a time to depart the final approach fix inbound (non precision approach) or the outer marker or fix used in lieu of the outer marker inbound (precision approach) is indicative that timed approach procedures are being utilized, or in lieu of holding, he may use radar vectors to the final approach course to establish a mileage interval between aircraft that will insure the appropriate time sequence between the final approach fix/outer marker or fix used in lieu of the outer marker and the airport.

c. Each pilot in an approach sequence will be given advance notice as to the time he should leave the holding point on approach to the airport. When a time to leave the holding point has been received, the pilot should adjust his flight path to leave the fix as closely as possible to the designated time.

EXAMPLE:

Time Approach Example — a final approach procedure from a holding pattern at a final approach fix (FAF).


LOM
LMM
1000 FT
1000 FT
1000 FT
1000 FT
REPORT LEAVING PREVIOUS ALTITUDE FOR NEW ASSIGNED ALTITUDE
ONE MINUTE FLYING TIME
APPROXIMATELY 5 MILES
AIRPORT
12:03 CLEARANCE RECEIVED
04 - INITIAL TIME OVER FIX
06½
30 SEC
05½
05
07 - REPORT LEAVING FINAL APPROACH FIX

At 12:03 local time, in the example shown, a pilot holding, receives instructions to leave the fix inbound at 12:07. These instructions are received just as the pilot has completed turn at the outbound end of the holding pattern and is proceeding inbound towards the fix. Arriving back over the fix, the pilot notes that the time is 12:04 and that he has 3 minutes to lose in order to leave the fix at the assigned time. Since the time remaining is more than 2 minutes, the pilot plans to fly a race track pattern rather than a 360 degrees turn, which would use up 2 minutes. The turns at the ends of the race track pattern will consume approximately 2 minutes. Three minutes to go, minus 2 minutes required for turns, leaves 1 minute for level flight. Since two portions of level flight will be required to get back to the fix inbound, the pilot halves the 1 minute remaining and plans to fly level for 30 seconds outbound before starting his turn back toward the fix on final approach. If the winds were negligible at flight altitude, this procedure would bring the pilot inbound across the fix precisely at the specified time of 12:07. However, if the pilot expected a headwind on final approach, he should shorten his 30 seconds outbound course somewhat, knowing that the wind will carry him away from the fix faster while outbound and decrease his ground speed while returning to the fix. On the other hand, if the pilot knew he would have a tailwind on final approach, he should lengthen his calculated 30-second outbound heading somewhat, knowing that the wind would tend to hold him closer to the fix while outbound and increase his ground speed while returning to the fix.

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373. RADAR APPROACHES

a. The only airborne radio equipment required for radar approaches is a functioning radio transmitter and receiver. The radar controller vectors the aircraft to align it with the runway centerline. The controller continues the vectors to keep the aircraft on course until the pilot can complete the approach and landing by visual reference to the surface. There are two types of radar approaches: Precision (PAR) and Surveillance (ASR).

b. A radar approach may be given to any aircraft upon request and may be offered to pilots of aircraft in distress or to expedite traffic, however, an ASR might not be approved unless there is an ATC operational requirement, or in an unusual or emergency situation. Acceptance of a PAR or ASR by a pilot does not waive the prescribed weather minimums for the airport or for the particular aircraft operator concerned. The decision to make a radar approach when the reported weather is below the established minimums rests with the pilot.

c. PAR and ASR minimums are published on separate pages in the NOS IAP Charts.

(1) **A PRECISION APPROACH (PAR)** is one in which a controller provides highly accurate nagivational guidance in azimuth and elevation to a pilot. Pilots are given headings to fly, to direct them to, and keep their aircraft aligned with the extended centerline of the landing runway. They are told to anticipate glide path interception approximately 10 to 30 seconds before it occurs and when to start descent. The published decision height will be given only if the pilot requests it. If the aircraft is observed to deviate above or below the glide path, the pilot is given the relative amount of deviation by use of terms "slightly" or "well" and is expected to adjust his rate of descent to return to the glide path. Trend information is also issued with respect to the elevation of the aircraft and may be modified by the terms "rapidly" and "slowly"; e.g., "well above glide path, coming down rapidly." Range from touchdown is given at least once each mile. If an aircraft is observed by the controller to proceed outside of specified safety zone limits in azimuth and/or elevation and continue to operate outside these prescribed limits, the pilot will be directed to execute a missed approach or to fly a specified course unless he has the runway environment (runway, approach lights, etc.) in sight. Navigational guidance in azimuth and elevation is provided the pilot until the aircraft reaches the published Decision Height (DH). Advisory course and glidepath information is furnished by the controller until the aircraft passes over the landing threshold, at which point the pilot is advised of any deviation from the runway centerline. Radar service is automatically terminated upon completion of the approach.

(2) **A SURVEILLANCE APPROACH (ASR)** is one in which a controller provides navigational guidance in azimuth only. The pilot is furnished headings to fly to align his aircraft with the extended centerline of the landing runway. Since the radar information used for a surveillance approach is considerably less precise than that used for a precision approach, the accuracy of the approach will not be as great and higher minimums will apply. Guidance in elevation is not possible but the pilot will be advised when to commence descent to the minimum descent altitude (MDA) or, if appropriate, to an intermediate step-down fix minimum crossing altitude and subsequently to the prescribed MDA. In addition, the pilot will be advised of the location of the missed approach point (MAP) prescribed for the procedure and his position each mile on final from the runway, airport or heliport or MAP, as appropriate. If requested by the pilot, recommended altitudes will be issued at each mile, based on the descent gradient established for the procedure, down to the last mile that is at or above the MDA. Normally, navigational guidance will be provided until the aircraft reaches the MAP. Controllers will terminate guidance and instruct the pilot to execute a missed approach unless at the MAP the pilot has the runway, airport or heliport in sight or, for a helicopter point-in-space approach, the prescribed visual reference with the surface is established. Also, if, at any time during the approach the controller considers that safe guidance for the remainder of the approach can not be provided, he will terminate guidance and instruct the pilot to execute a missed approach. Similarly, guidance termination and missed approach will be effected upon pilot request and, for civil aircraft only, controllers may terminate guidance when the pilot reports the runway, airport/heliport or visual surface route (point-in-space approach) in sight or otherwise indicates that continued guidance is not required. Radar service is automatically terminated at the completion of a radar approach.

NOTE.— The published MDA for straight-in approaches will be issued to the pilot before beginning descent. When a surveillance approach will terminate in a circle to land maneuver, the pilot must furnish the aircraft approach category to the controller. The controller will then provide the pilot with the appropriate MDA.

(3) **A NO-GYRO APPROACH** is available to a pilot under radar control who experiences circumstances wherein his directional gyro or other stabilized compass is inoperative or inaccurate. When this occurs, he should so advise ATC and request a No-Gyro vector or approach. Pilots of aircraft not equipped with a directional gyro or other stabilized compass who desire radar handling may also request a No-Gyro vector or approach. The pilot should make all turns at standard rate and should execute the turn immediately upon receipt of instructions. For example, "TURN RIGHT," "STOP TURN." When a surveillance or precision approach is made, the pilot will be advised after his aircraft has been turned onto final approach to make turns at half standard rate.

374. RADAR MONITORING OF INSTRUMENT APPROACHES

a. PAR facilities operated by the FAA and the military services at some joint-use (civil and military) and military installations monitor aircraft on instrument approaches and issue radar advisories to the pilot when weather is below VFR minimums (1,000 and 3), at night, or when requested by a pilot. This service is provided only when the PAR final approach course coincides with the final approach of the navigational aid and only during the operational hours of the PAR. The radar advisories serve only as a secondary aid since the pilot has selected the navigational aid as the primary aid for the approach.

b. Prior to starting final approach, the pilot will be advised of the frequency on which the advisories will be transmitted. If, for any reason, radar advisories cannot be furnished, the pilot will be so advised.

c. Advisory information, derived from radar observations, includes information on:

(1) Passing the final approach fix inbound (non precision approach) or passing the outer marker or fix used in lieu of the outer marker inbound (precision approach).

NOTE.— At this point, the pilot may be requested to report sighting the approach lights or the runway.

(2) Trend advisories with respect to elevation and/or azimuth radar position and movement will be provided.

NOTE.— Whenever the aircraft nears the PAR safety limit, the pilot will be advised that he is well above or below the glidepath or well left or right of course. Glidepath information is given only to those aircraft executing a precision approach, such as ILS or MLS. Altitude information is not transmitted to aircraft executing other than precision approaches because the descent portions of these approaches generally do not coincide with the depicted PAR glidepath. At locations where the MLS glidepath and PAR glidepath are not coincidental, only azimuth monitoring will be provided.

(3) If, after repeated advisories, the aircraft proceeds outside the PAR safety limit or if a radical deviation is observed, the pilot will be advised to execute a missed approach unless the prescribed visual reference with the surface is established.

d. Radar service is automatically terminated upon completion of the approach.

375. SIMULTANEOUS ILS/MLS APPROACHES

a. **System:** An approach system permitting simultaneous ILS/MLS, or ILS and MLS approaches to airports having parallel runways separated by at least 4,300 feet between centerlines. Integral parts of a total system are ILS or MLS, radar, communications, ATC procedures, and appropriate airborne equipment. The Approach Procedure Chart permitting simultaneous approaches will contain the note "simultaneous approach authorized Rwys 14L and 14R" identifying the appropriate runways as the case may be. When advised that simultaneous ILS approaches are in progress, pilots shall advise approach control immediately of malfunctioning or inoperative receivers or if simultaneous approach is not desired.

b. **Radar Monitor Service:** This service is provided for each ILS/MLS to insure prescribed lateral separation during approaches. Pilots will be assigned frequencies to receive advisories and instructions. Aircraft deviating from either final approach course to the point where the no transgression zone (an area at least 2,000 feet wide) may be penetrated will be instructed to take corrective action. If an aircraft fails to respond to such instruction, the aircraft on the adjacent final approach course may be instructed to alter course.

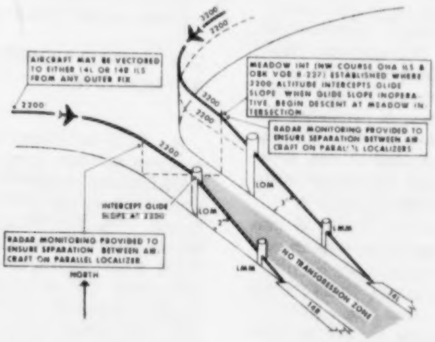
c. **Radar Advisories:** Whenever simultaneous approaches are in progress radar advisories will be provided on the tower frequency.

(1) The monitor controller will have the capability of overriding the tower controller on the tower frequency.

(2) The pilot will be advised to monitor the tower frequency.

(3) The monitor will automatically be terminated no farther than one mile from the runway threshold.

(4) The monitor controller will *not* advise when the monitor is terminated.


2200
2200
AIRCRAFT MAY BE VECTORED TO EITHER 14L OR 14R ILS FROM ANY OUTER FIX
MEADOW INT (NW COURSE OMA ILS & OBK VOR R-227) ESTABLISHED WHERE 2200 ALTITUDE INTERCEPTS GLIDE SLOPE. WHEN GLIDE SLOPE INOPERATIVE BEGIN DESCENT AT MEADOW INTERSECTION
2200
2200
2200
RADAR MONITORING PROVIDED TO ENSURE SEPARATION BETWEEN AIRCRAFT ON PARALLEL LOCALIZERS
2200
LOM
INTERCEPT GLIDE SLOPE AT 2200
LOM
LMM
RADAR MONITORING PROVIDED TO ENSURE SEPARATION BETWEEN AIRCRAFT ON PARALLEL LOCALIZER
NORTH
LMM
NO TRANSGRESSION ZONE
14L
14R

376. PARALLEL ILS/MLS APPROACHES

a. Parallel approaches are an ATC procedure permitting parallel ILS, MLS, or ILS and MLS approaches to airports having parallel runways separated by at least 2,500 feet between centerlines. Integral parts of a total system are ILS or MLS, radar, communications, ATC procedures, and appropriate airborne equipment.

b. A parallel approach differs from a simultaneous approach in that the minimum distance between parallel runway centerlines is reduced; there is no requirement for radar monitoring or advisories; and a staggered separation of aircraft on the adjacent localizer course is required.

c. Aircraft are afforded a minimum of two miles radar separation between successive aircraft on the adjacent localizer course and a minimum of three miles radar separation from aircraft on the same final approach course. In addition, a minimum of 1,000 feet vertical or a minimum of three miles radar separation is provided between aircraft during turn on.

d. Whenever parallel approaches are in progress, aircraft are informed that approaches to both runways are in use. In addition, the radar controller will have the interphone capability of communicating directly with the tower controller where the responsibility for radar separation is not performed by the tower controller.

377. SIMULTANEOUS CONVERGING INSTRUMENT APPROACHES

a. ATC may conduct instrument approaches simultaneously to converging runways; i.e., runways having an included angle from 15 to 100 degrees, at airports where a program has been specifically approved to do so.

b. The basic concept requires that dedicated, separate standard instrument approach procedures be developed for each converging runway included. Missed approach points must be as least 3 miles apart and missed approach procedures ensure that missed approach protected airspace does not overlap.

c. Other requirements are: radar availability, nonintersecting final approach courses, precision (ILS/MLS) approach systems on each runway and, if runways intersect, controllers must be able to apply visual separation as well as intersecting runway separation criteria. Intersecting runways also require minimums of at least 700 and 2. Straight in approaches and landings must be made.

d. Whenever simultaneous converging approaches are in progress, aircraft will be informed by the controller as soon as feasible after initial contact or via ATIS. Additionally, the radar controller will have direct communications capability with the tower controller where separation responsibility has not been delegated to the tower.

378—379. RESERVED

380. SIDE-STEP MANEUVER

a. ATC may authorize an approach procedure which serves either one of parallel runways that are separated by 1,200 feet or less followed by a straight-in landing on the adjacent runway.

b. Aircraft that will execute a side-step maneuver will be cleared for a specified approach and landing on the adjacent parallel runway. Example, "cleared for ILS runway 07 left approach, side-step to runway 07 right." Pilots are expected to commence the side-step maneuver as soon as possible after the runway or runway environment is in sight.

c. Landing minimums to the adjacent runway will be higher than the minimums to the primary runway, but will normally be lower than the published circling minimums.

381. WEATHER MINIMUMS

a. LANDING MINIMUMS. The rules applicable to landing minimums are contained in FAR—91.116.

b. Straight-in-minimums are shown on IAP charts when the final approach course of the IAP is within 30 degrees of the runway alignment and a normal descent can be made from the IFR altitude shown on the IAPs to the runway surface. When either the normal rate of descent or the runway alignment factor of 30 degrees is exceeded, a straight-in minimum is not published and a circling minimum applies. The fact that a straight-in minimum is not published does not preclude the pilot from landing straight-in if he has the active runway in sight and has sufficient time to make a normal approach for landing. Under such conditions and when ATC has cleared him for landing on that runway, he is not expected to circle even though only circling minimums are published. If he desires to circle he should advise ATC.

c. Side-Step Maneuver Minimums — Landing minimums for a side-step maneuver to the adjacent runway will be higher than the minimums to the primary runway but will normally be lower than the published circling minimums.

d. Circling Minimums —The circling minimums published on the instrument approach chart provide adequate obstruction clearance and the pilot should not descend below the circling altitude until the aircraft is in a position to make final descent for landing. Sound judgement and knowledge of his and the aircraft's capabilities are the criteria for a pilot to determine the exact maneuver in each instance since airport design and the aircraft position, altitude and airspeed must all be considered. The following basic rules apply:

(1) Maneuver the shortest path to the base or downwind leg, as appproriate, under minimum weather conditions. There is no restriction from passing over the airport or other runways.

(2) It should be recognized that many circling maneuvers may be made while VFR or other flying is in progress at the airport. Standard left turns or specific instruction from the controller for maneuvering must be considered when circling to land.

(3) At airports without a control tower, it may be desirable to fly over the airport to determine wind and turn indicators, and to observe other traffic which may be on the runway or flying in the vicinity of the airport.

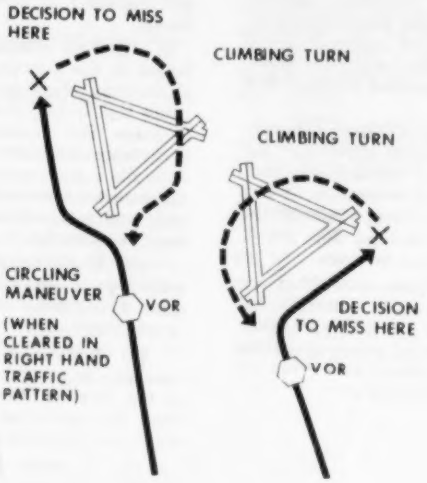
e. Instrument Approach At a Military Field — When instrument approaches are conducted by civil aircraft at military airports, they shall be conducted in accordance with the procedures and minimums approved by the military agency having jurisdiction over the airport.

382. MISSED APPROACH

a. When a landing cannot be accomplished, advise ATC and, upon reaching the missed approach point defined on the approach procedure chart, the pilot must comply with the missed approach instructions for the procedure being used or with an alternate missed approach procedure specified by ATC.

b. Protected obstacle clearance areas for missed approach are predicated on the assumption that the abort is initiated at the missed approach point not lower than the MDA or DH. Reasonable buffers are provided for normal maneuvers. However, no consideration is given to an abnormally early turn. Therefore, when an early missed approach is executed, pilots should, unless otherwise cleared by ATC, fly the IAP as specified on the approach plate to the missed approach point at or above the MDA or DH before executing a turning maneuver.

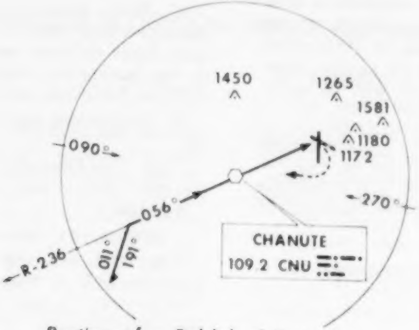
c. If visual reference is lost while circling to land from an instrument approach, the missed approach specified for that particular procedure must be followed (unless an alternate missed approach procedure is specified by ATC). To become established on the prescribed missed approach course, the pilot should make an initial climbing turn toward the landing runway and continue the turn until he is established on the missed approach course. Inasmuch as the circling maneuver may be accomplished in more than one direction, different patterns will be required to become established on the prescribed missed approach course, depending on the aircraft position at the time visual reference is lost. Adherence to the procedure will assure that an aircraft will remain within the circling and missed approach obstruction clearance areas.


DECISION TO MISS HERE
CLIMBING TURN
CLIMBING TURN
CIRCLING MANEUVER
(WHEN CLEARED IN RIGHT HAND TRAFFIC PATTERN)
VOR
DECISION TO MISS HERE
VOR

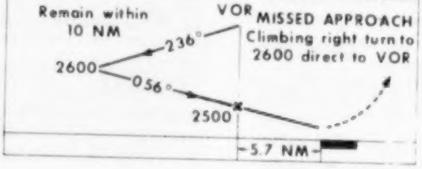
d. At locations where ATC Radar Service is provided, the pilot should conform to radar vectors when provided by ATC in lieu of the published missed approach procedure.

See diagram next page.

MISSED APPROACH-EXAMPLE



Portion of a Published Procedure



e. When approach has been missed, request clearance for specific action; i.e., to alternative airport, another approach, etc.

383. VISUAL APPROACH

a. When it will be operationally beneficial, ATC may authorize an aircraft to conduct a visual approach to an airport or to follow another aircraft when flight to, and landing at, the airport can be accomplished in VFR weather. The aircraft must have the airport or the identified preceding aircraft in sight before the clearance is issued. If the pilot has the airport in sight but cannot see the aircraft he is following, ATC may still clear the aircraft for a visual approach; however, ATC retains both separation and wake vortex separation responsibility. When visually following a preceding aircraft, acceptance of the visual approach clearance, constitutes acceptance of pilot responsibility for maintaining a safe approach interval and adequate wake turbulence separation.

b. When operating to an airport with an operating control tower, aircraft may be authorized to conduct a visual approach to one runway while other aircraft are conducting IFR or VFR approaches to another runway. When operating to airports with parallel runways separated by less than 2,500 feet, the succeeding aircraft must report sighting the preceding aircraft unless standard separation is being provided by ATC. When operating to parallel runways separated by at least 2,500 feet but less than 4,300 feet, controllers will clear/vector aircraft to the final at an angle not greater than 30 degrees unless radar, vertical, or visual separation is provided during the turn-on. The purpose of the 30 degree intercept angle is to reduce the potential for overshoots of the final and to preclude side-by-side operations with one or both aircraft in a *belly-up* configuration during the turn-on. Once the aircraft are established within 30 degrees of final, or on the final, these operations may be conducted simultaneously. When the parallel runways are separated by 4,300 feet or more, or intersecting/converging runways are in use, ATC may authorize a visual approach after advising all aircraft involved that other aircraft are conducting operations to the other runway.

c. When operating to an airport without weather reporting service, ATC may initiate a visual approach provided area weather reports indicate that VFR conditions exist at the airport and there is reasonable assurance that descent and flight to the airport can be made in VFR conditions. Pilot acceptance of a visual approach clearance or a pilot's request for a visual approach will indicate to ATC that the pilot can comply with FAR 91.105. ATC will advise the pilot when weather is not available at the destination airport.

d. Authorization to conduct a visual approach is an IFR authorization and does not alter IFR flight plan cancellation responsibility. (See PARA—304 - CANCELLING IFR FLIGHT PLAN.)

e. A visual approach is not an IAP and therefore has no missed approach segment. If a go around is necessary for any reason, aircraft operating at controlled airports will be issued an appropriate advisory/clearance/instruction by the tower. At uncontrolled airports, aircraft are expected to remain in VFR conditions and complete a landing as soon as possible. If a landing cannot be accomplished, the aircraft is expected to remain in VFR conditions and contact ATC as soon as possible for further clearance. Separation from other IFR aircraft will be maintained under these circumstances.

f. Visual approaches are initiated by ATC to reduce pilot/controller workload and expedite traffic by shortening flight paths to the airport. It is the pilot's responsibility to advise ATC as soon as possible if a visual approach is not desired.

384. CHARTED VISUAL FLIGHT PROCEDURES (CVFP)

a. CVFPs are charted visual approaches established at locations with jet operations for noise abatement purposes. The approach charts depict prominent landmarks, coures, and recommended altitudes to specific runways.

b. These procedures will be used only in a radar environment at airports with an operating control tower.

c. Most approach charts will depict some NAVID information which is for supplemental navigational guidance only.

d. Unless indicating a TCA floor, all depicted altitudes are for noise abatement purposes and are recommended only. Pilots are not prohibited from flying other than recommended altitudes if operational requirements dictate.

e. When landmarks used for navigation are not visible at night, the approach will be annotated "PROCEDURE NOT AUTHORIZED AT NIGHT."

f. CVFPs usually begin within 15 flying miles from the airport.

g. Published weather minimums for CVFPs are based on minimum vectoring altitudes rather than the recommended altitudes depicted on charts.

h. CVFPs are not instrument approaches and do not have missed approach segments.

i. ATC will not issue clearances for CVFPs when the weather is less than the published minimum.

j. ATC will clear aircraft for a CVFP after the pilot reports siting a charted landmark or a preceding aircraft. If instructed to follow a preceding aircraft, pilots are responsible for maintaining a safe approach interval and wake turbulence separation.

k. Pilots should advise ATC if at any point they are unable to continue an approach or lose site of a preceding aircraft. Missed approaches will be handled as a go-around.

385. CONTACT APPROACH

a. Pilots operating in accordance with an IFR flig plan, provided they are clear of clouds and have at least mile flight visibility and can reasonably expect to continu to the destination airport in those conditions, may reques ATC authorization for a contact approach.

b. Controllers may authorize a contact approach provided:

(1) The Contact Approach is specifically requested b the pilot. ATC cannot initiate this approach.

EXAMPLE:

REQUEST CONTACT APPROACH.

(2) The reported ground visibility at the destination airport is at least 1 statute mile.

(3) The contact approach will be made to an airport having a standard or special instrument approach procedure.

(4) Approved separation is applied between aircraft so cleared and between these aircraft and other IFR or special VFR aircraft.

EXAMPLE:

CLEARED FOR CONTACT APPROACH (and, if required) AT OR BELOW (altitude) (Routing) IF NOT POSSIBLE (alternative procedures) AND ADVISE.

c. A Contact Approach is an approach procedure that may be used by a pilot (with prior authorization from ATC in lieu of conducting a standard or special IAP to an airport. It is not intended for use by a pilot on an IFR flight clearance to operate to an airport not having an authorized IAP. Nor is it intended for an aircraft to conduct an instrument approach to one airport and then, when "in the clear", to discontinue that approach and proceed to another airport. In the execution of a contact approach, the pilot assumes the responsibility for obstruction clearance If radar service is being received, it will automatically terminate when the pilot is told to contact the tower.

386. LANDING PRIORITY

A clearance for a specific type of approach (ILS, MLS ADF, VOR or Straight-in Approach) to an aircraft operating on an IFR flight plan does not mean that landing priority will be given over other traffic. ATCTs handle all aircraft, regardless of the type of flight plan, on a "first-come first-served" basis. Therefore, because of local traffic or runway in use, it may be necessary for the controller in the interest of safety, to provide a different landing sequence. In any case, a landing sequence will be issued to each aircraft as soon as possible to enable the pilot to properly adjust his flight path.

387—399. RESERVED

Section 9. PILOT/CONTROLLER ROLES AND RESPONSIBILITIES

400. GENERAL

a. The roles and responsibilities of the pilot and controller for effective participation in the ATC system are contained in several documents. Pilot responsibilities are in the FARs and the air traffic controller's are in the Air Traffic Control Handbook (7110.65) and supplemental FAA directives. Additional and supplemental information for pilots can be found in the current Airman's Information Manual (AIM), Notices to Airmen, Advisory Circulars and aeronautical charts. Since there are many other excellent publications produced by nongovernment organizations, as well as other government organizations, with various updating cycles, questions concerning the latest or most current material can be resolved by cross-checking with the above mentioned documents.

b. The pilot in command of an aircraft is directly responsible for, and is the final authority as to the safe operation of that aircraft. In an emergency requiring immediate action, the pilot in command may deviate from any rule in the General Subpart A and Flight Rules Subpart B in accordance with FAR—91.3.

c. The air traffic controller is responsible to give first priority to the separation of aircraft and to the issuance of radar safety alerts, second priority to other services that are required, but do not involve separation of aircraft and third priority to additional services to the extent possible.

d. In order to maintain a safe and efficient air traffic system, it is necessary that each party fulfill his responsibilities to the fullest.

e. The responsibilities of the pilot and the controller intentionally overlap in many areas providing a degree of redundancy. Should one or the other fail in any manner, this overlapping responsibility is expected to compensate, in many cases, for failures that may affect safety. I11 f. The following, while not intended to be all inclusive, is a brief listing of pilot and controller responsibilities for some commonly used procedures or phases of flight. More detailed explanations are contained in other portions of this publication, the appropriate FARs, ACs and similar publications. The information provided is an overview of the principles involved and is not meant as an interpretation of the rules nor is it intended to extend or diminish responsibilities.

401. AIR TRAFFIC CLEARANCE

a. Pilot

(1) Acknowledge receipt and understanding of an ATC clearance.

(2) Request clarification or amendment, as appropriate, any time a clearance is not fully understood, or considered unacceptable from a safety standpoint.

(3) Promptly comply with air traffic clearance upon receipt except as necessary to cope with an emergency. If deviation is necessary, advise ATC as soon as possible and obtain an amended clearance.

b. Controller

(1) Issues appropriate clearances for the operation to be conducted, or being conducted, in accordance with established criteria.

(2) Assigns altitudes in IFR clearances that are at or above the minimum IFR altitudes in controlled airspace.

(3) Ensures acknowledgement by the pilot for issued information, clearance or instructions.

(4) Ensures that readbacks by the pilot of altitude, heading, or other items are correct. If incorrect, distorted, or incomplete, makes corrections as appropriate.

402. CONTACT APPROACH

a. Pilot

(1) This approach must be requested by the pilot, and is made in lieu of a standard or special instrument approach.

(2) By requesting the contact approach, the pilot indicates that the flight is operating clear of clouds, has at least one mile flight visibility, and can reasonably expect to continue to the destination airport in those conditions.

(3) Be aware that while conducting a contact approach, the pilot assumes responsibility for obstruction clearance.

(4) Advise ATC immediately if you are unable to continue the contact approach or if you encounter less than one mile flight visibility.

b. Controller

(1) Issues clearance for contact approach only when requested by the pilot. Does not solicit the use of this procedure.

(2) Before issuing clearance, ascertains that reported ground visibility at destination airport is at least one mile.

(3) Provides approved separation between aircraft cleared for contact approach and other IFR or special VFR aircraft. When using vertical separation, does not assign a fixed altitude but clears the aircraft at or below an altitude which is at least 1,000 feet below any IFR traffic but not below minimum safe altitudes prescribed in FAR—91.79.

(4) Issues alternative instructions if, in his judgment, weather conditions may make completion of the approach impracticable.

403. INSTRUMENT APPROACH

a. Pilot

(1) Be aware that the controller issues clearance for approach based only on known traffic.

(2) Follow the procedure as shown on the IAP, including all restrictive notations, such as:

(a) Procedure not authorized at night;

(b) Approach not authorized when local area altimeter not available;

(c) Procedure not authorized when control tower not in operation;

(d) Procedure not authorized when glide slope not used;

(e) Straight-in minimums not authorized at night; etc.

(f) Radar required; or

(g) The circling minimums published on the instrument approach chart provide adequate obstruction clearance and the pilot should not descend below the circling altitude until the aircraft is in a position to make final descent for landing. Sound judgment and knowledge of his and the aircraft's capabilities are the criteria for a pilot to determine the exact maneuver in each instance since airport design and the aircraft position, altitude and airspeed must all be considered. (See PARA—381d, - CIRCLING MINIMUMS)

(3) Upon receipt of an approach clearance while on an unpublished route or being radar vectored:

(a) Comply with the minimum altitude for IFR, and

(b) Maintain last assigned altitude until established on a segment of a published route or IAP, at which time published altitudes apply.

b. Controller

(1) Issues an approach clearance based on known traffic.

(2) Issues an IFR approach clearance only after the aircraft is established on a segment of published route or IAP, or assigns an appropriate altitude for the aircraft to maintain until so established.

404. MISSED APPROACH

a. Pilot

(1) Execute a missed approach when one of the following conditions exist:

(a) Arrival at the Missed Approach Point (MAP) or the Decision Height (DH) and visual reference to the runway environment is insufficient to complete the landing.

(b) Determined that a safe landing is not possible.

(c) Instructed to do so by ATC.

(2) Advise ATC that a missed approach will be made. Include the reason for the missed approach unless the missed approach is initiated by ATC.

(3) Comply with the missed approach instructions for the IAP being executed unless other *missed approach* instructions are specified by ATC.

(4) If executing a missed approach prior to reaching the MAP or DH, fly the instrument procedure to the MAP at an altitude at or above the Minimum Descent Altitude (MDA) or DH before executing a turning maneuver.

(5) Radar vectors issued by ATC when informed that a missed approach is being executed supersedes the previous missed approach procedure.

(6) If making a missed approach from a radar approach, execute the missed approach procedure previously given or climb to the altitude and fly the heading specified by the controller.

(7) Following missed approach, request clearance for specific action; i.e., another approach, hold for improved conditions, proceed to an alternate airport, etc.

b. Controller

(1) Issues an approved alternate missed approach procedure if it is desired that the pilot execute a procedure other than as depicted on the instrument approach chart.

(2) May vector a radar identified aircraft executing a missed approach when operationally advantageous to the pilot or the controller.

(3) In response to the pilot's stated intentions, issues a clearance to an alternate airport, to a holding fix, or for reentry into the approach sequence, as traffic conditions permit.

405. RADAR VECTORS

a. Pilot

(1) Promptly comply with headings and altitudes assigned to you by the controller.

(2) Question any assigned heading or altitude believed to be incorrect.

(3) If operating VFR and compliance with any radar vector or altitude would cause a violation of any FAR, advise ATC and obtain a revised clearance or instruction.

b. Controller

(1) Vectors aircraft in controlled airspace:

(a) For separation.

(b) For noise abatement.

(c) To obtain an operational advantage for the pilot or controller.

(2) Vectors aircraft in controlled and uncontrolled airspace when requested by the pilot.

(3) Vectors IFR aircraft at or above minimum vectoring altitudes.

(4) May vector VFR aircraft, not at an ATC assigned altitude, at any altitude. In these cases, terrain separation is the pilot's responsibility.

406. SAFETY ALERT

a. Pilot

(1) Initiate appropriate action if a safety alert is received from ATC.

(2) Be aware that this service is not always available and that many factors affect the ability of the controller to be aware of a situation in which unsafe proximity to terrain, obstructions or another aircraft may be developing.

b. Controller

(1) Issues a safety alert if he is aware an aircraft under his control is at an altitude which, in the controller's judgment, places the aircraft in unsafe proximity to terrain, obstructions or another aircraft. Types of safety alerts are:

(a) Terrain or Obstruction Alert: — Immediately issued to an aircraft under his control if he is aware the aircraft is at an altitude believed to place the aircraft in unsafe proximity to terrain or obstructions.

(b) Aircraft Conflict Alert: — Immediately issued to an aircraft under his control if he is aware of an aircraft not under his control at an altitude believed to place the aircraft in unsafe proximity to each other. With the alert, he offers the pilot an alternative, if feasible.

(2) Discontinues further alerts if informed by the pilot that he is taking action to correct the situation or that he has the other aircraft in sight.

407. SEE AND AVOID

a. Pilot

(1) When meteorological conditions permit, regardless of type of flight plan, whether or not under control of a radar facility, the pilot is responsible to see and avoid other traffic, terrain or obstacles.

b. Controller

(1) Provides radar traffic information to radar identified aircraft operating outside positive control airspace on a workload permitting basis.

(2) Issues a safety alert to an aircraft under his control if he is aware the aircraft is at an altitude believed to place the aircraft in unsafe proximity to terrain, obstructions or other aircraft.

408. SPEED ADJUSTMENTS

a. Pilot

(1) Advise ATC any time cruising airspeed varies plus or minus 5 percent, or 10 knots, whichever is greater, from that given in the flight plan.

(2) Comply with speed adjustments from ATC unless:

(a) The minimum or maximum safe airspeed for any particular operation is greater or less than the requested airspeed. In such cases, advise ATC.

(b) Operating at or above 10,000 feet MSL on an ATC assigned SPEED ADJUSTMENT of more than 250 knots IAS and subsequent clearance is received for descent below 10,000 feet MSL. In such cases, pilots are expected to comply with FAR—91.70(a).

(3) When complying with speed adjustments assignment, maintain an indicated airspeed within plus or minus 10 knots or .02 mach numbers of the specified speed.

b. Controller

(1) Assigns speed adjustments to aircraft when necessary but not as a substitute for good vectoring technique.

(2) Adheres to the restrictions published in the Controllers Handbook (7110.65) as to when speed adjustment procedures may be applied.

(3) Avoids speed adjustments requiring alternate decreases and increases.

(4) Assigns speed adjustments to a specified IAS (KNOTS)/mach number or to increase or decrease speed using increments of 10 knots or multiples thereof.

(5) Advises pilots to resume normal speed when speed adjustments are no longer required.

(6) Gives due consideration to aircraft capabilities to reduce speed while descending.

409. TRAFFIC ADVISORIES (Traffic Information)

a. G2Pilot

(1) Acknowledge receipt of traffic advisories.

(2) Inform controller if traffic in sight.

(3) Advise ATC if a vector to avoid traffic is desired.

(4) Do not expect to receive radar traffic advisories on all traffic. Some aircraft may not appear on the radar display. Be aware that the controller may be occupied with higher priority duties and unable to issue traffic information for a variety of reasons.

(5) Advise controller if service not desired.

b. Controller

(1) Issues radar traffic to the maximum extent consistent with higher priority duties except in positive controlled airspace.

(2) Provides vectors to assist aircraft to avoid observed traffic when requested by the pilot.

(3) Issues traffic information to aircraft in the airport traffic area for sequencing purposes.

410. VISUAL APPROACH

a. Pilot

(1) If a visual approach is not desired, advise ATC.

(2) Comply with controller's instructions for vectors toward the airport of intended landing or to a visual position behind a preceding aircraft.

(3) After being cleared for a visual approach, proceed to the airport in a normal manner or follow designated traffic and/or charted flight procedures, as appropriate remaining in VFR at all times.

(4) Acceptance of a visual approach clearance to visually follow a preceeding aircraft is pilot acknowledgement that he will establish a safe landing interval behind the preceding aircraft, if so cleared, and that he accepts responsibility for his own wake turbulence separation.

(5) Advise ATC immediately if you are unable to continue following a designated aircraft or encounter less than basic VFR weather conditions.

(6) Be aware that radar service is automatically terminated without advising the pilot when the aircraft is instructed to contact the tower.

(7) Be aware that there may be other traffic in the traffic pattern and the landing sequence may differ from the traffic sequence assigned by the approach control or ARTCC.

b. Controller

(1) Does not vector an aircraft for a visual approach to an airport with weather reporting service unless the reported ceiling at the airport is 500 feet or more above the MVA and visibility is three miles or more.

(2) Informs the pilot when weather is not available for the destination airport and does not vector for a visual approach to those airports unless there is reasonable assurance that descent and flight to the airport can be made in VFR conditions.

(3) Does not clear an aircraft for a visual approach unless the aircraft is and can remain in VFR conditions.

(4) Issues visual approach clearance when the pilot reports sighting the airport or a preceding aircraft which is to be followed.

(5) Provides separation except when visual separation is being applied by the pilot of the aircraft executing the visual approach.

(6) Continues flight following and traffic information until the aircraft is instructed to contact the tower.

(7) Informs the pilot conducting the visual approach of the aircraft class when pertinent traffic is known to be a heavy aircraft.

411. VISUAL SEPARATION

a. Pilot

(1) Acceptance of instructions to follow another aircraft or to provide visual separation from it is an acknowledgment that the pilot will maneuver his/her aircraft as necessary to avoid the other aircraft or to maintain in-trail separation.

(2) If instructed by ATC to follow another aircraft or to provide visual separation from it, promptly notify the controller if you lose sight of that aircraft, are unable to maintain continued visual contact with it, or cannot accept the responsibility for your own separation for any reason.

(3) The pilot also accepts responsibility for wake turbulence separation under these conditions.

b. Controller

(1) Applies visual separation only within a terminal area when a controller has both aircraft in sight or by instructing a pilot who sees the other aircraft to maintain visual separation from it.

412. VFR-ON-TOP

a. Pilot

(1) This clearance must be requested by the pilot on an IFR flight plan and if approved, permits the pilot to select an altitude or flight level of his choice (subject to any ATC restrictions) in lieu of an assigned altitude.

Note 1.— VFR-ON-TOP is not permitted in certain airspace areas, such as positive control airspace, certain restricted areas, ect. Consequently, IFR flights operating VFR-ON-TOP will avoid such airspace.

Note 2.— See related AIM paragrphs, 98 - IFR Altitudes and Flight Levels, 266 - IFR Clearance VFR-ON-TOP, 271 - IFR Separation Standards, 341 - Position Reporting, and 342 - Additional Reports.

(2) By requesting a VFR-ON-TOP clearance, the pilot indicates that he is assuming the sole responsibility to be vigilant so as to see and avoid other aircraft and that he will:

(a) Fly at the appropriate VFR altitude as prescribed in FAR—91.109.

(b) Comply with the VFR visibility and distance from criteria in FAR—91.105 (Basic VFR Weather Minimums).

(c) Comply with instrument flight rules that are applicable to this flight (i.e., minimum IFR altitudes, position reporting, radio communications, course to be flown, adherence to ATC clearance, etc.).

(3) Should advise ATC prior to any altitude change to ensure the exchange of accurate traffic information.

b. Controller

(1) May clear an aircraft to maintain VFR-ON-TOP if the pilot of an aircraft on an IFR flight plan requests the clearance.

(2) Inform the pilot of an aircraft cleared to climb to VFR-ON-TOP: the reported height of the tops or that no top report is available, issues an alternate clearance if necessary, and once the aircraft reports reaching VFR-ON-TOP, reclears the aircraft to maintain VFR-ON-TOP.

(3) Before issuing clearance, ascertains that the aircraft is not in or will not enter positive control airspace.

413. INSTRUMENT DEPARTURES

a. Pilot

(1) Prior to Departure: Consider the type of terrain and other obstructions on or in the vicinity of the departure airport.

(2) Determine if obstruction avoidance can be maintained visually or that the departure procedure should be followed.

(3) Determine whether a departure procedure and/or SID is available for obstruction avoidance.

(4) At airports where IAPs have not been published, hence no published departure procedure, determine what action will be necessary and take such action that will assure a safe departure.

b. Controller

(1) At locations with airport traffic control service, when necessary, specifies direction of takeoff, turn or initial heading to be flown after takeoff.

(2) At locations without airport traffic control service, but within a control zone when necessary to specify direction of takeoff/turn or initial heading to be flown, obtains pilot's concurrence that the procedure will allow him to comply with local traffic patterns, terrain, and obstruction avoidance.

(3) Includes established departure procedures as part of the ATC clearance when pilot compliance is necessary to ensure separation.

414. MINIMUM FUEL ADVISORY

a. Pilot

(1) Advise ATC of your minimum fuel status when your fuel supply has reached a state where, upon reaching destination, you cannot accept any undue delay.

(2) Be aware this is not an emergency situation but merely an advisory that indicates an emergency situation is possible should any undue delay occur.

(3) Be aware a minimum fuel advisory does not imply a need for traffic priority.

(4) If the remaining usable fuel supply suggests the need for traffic priority to ensure a safe landing you should declare an emergency, account low fuel, and report fuel remaining in minutes.

b. Controller

(1) When an aircraft declares a state of minimum fuel, relay this information to the facility to whom control jurisdiction is transferred.

(2) Be alert for any occurrence which might delay the aircraft.

415—429. RESERVED

NOTES

Section 10. NATIONAL SECURITY AND INTERCEPTION PROCEDURES

430. NATIONAL SECURITY

a. National security in the control of air traffic is governed by (FAR—99).

b. All aircraft entering domestic U.S. airspace from points outside must provide for identification prior to entry. To facilitate early aircraft identification of all aircraft in the vicinity of U.S. and international airspace boundaries, Air Defense Identification Zones (ADIZ) have been established. (See PARA—433 - ADIZ BOUNDARIES AND DESIGNATED MOUNTAINOUS AREAS.)

c. Operational requirements for aircraft entering an ADIZ are as follows:

(1) Flight Plan — A flight plan must be filed with an appropriate aeronautical facility for flight in an ADIZ. In the Alaskan DEWIZ (Distant Early Warning Identification Zone), the flight plan must be filed before departure, except as otherwise permitted in FAR—99.13.

(2) Two-way Radio — An operative two-way radio must be available for flight in ADIZ/DEWIZ areas. Exceptions are only as provided in FAR—99.1.

(3) Position Reporting — Normal IFR position reports are required in all ADIZ/DEWIZ areas. In the domestic and coastal ADIZ areas, flights under Defense VFR (DVFR) flight plans must give the estimated time of ADIZ penetration at least 15 minutes prior to penetration. In the coastal ADIZ, inbound foreign aircraft must report at least 1 hour prior to ADIZ penetration. In the Alaskan DEWIZ, DVFR flights must report prior to penetration (correlation of ground filed flight plan data may be required).

(4) Aircraft Position Tolerances:

(a) In a domestic ADIZ tolerance is within plus or minus 5 minutes from the estimated time over a reporting point or point of penetration and within 10 NM from the centerline of an intended track over an estimated reporting point or penetration point.

(b) In a Coastal ADIZ/DEWIZ the tolerance is plus or minus 5 minutes from the estimated time over a reporting point or point of penetration and within 20 NM from the centerline of the intended track over an estimated reporting point or point of penetration.

d. Aircraft operating within an ADIZ may be exempted from the National Security requirements of FAR—99 (except as may be applicable under FAR—99.7) if the aircraft is operating:

(1) Within the 48 contiguous states and the District of Columbia, or within the State of Alaska, and remains within 10 miles of departure point.

(2) In a Coastal or Domestic ADIZ north of 30 degrees North latitude or west of 86 degrees West longitude at a true air speed of less than 180 knots.

(3) In Alaskan DEWIZ at TAS of less than 180 knots while pilot maintains listening watch on appropriate frequency.

(4) Over or within three miles of any island in Hawaiian Coastal ADIZ.

e. Exemptions (except for FAR—99.7) may also be granted by the ARTCC, on a local basis, for some operations within an ADIZ.

f. An Airfiled VFR Flight Plan makes an aircraft subject to interception for positive identification when entering an ADIZ. Pilots are therefore urged to file the required DVFR flight plan either in person or by telephone prior to departure.

g.Special Security Instructions

(1) During defense emergency or air defense emergency conditions, additional special security instructions may be issued in accordance with the Security Control of Air Traffic and Air Navigation Aids (SCATANA) Plan.

(2) Under the provisions of the SCATANA Plan, the military will direct the action to be taken—in regard to landing, grounding, diversion, or dispersal of aircraft and the control of air navigation aids in the defense of the U.S. during emergency conditions.

(3) At the time a portion of all of SCATANA is implemented, ATC facilities will broadcast appropriate instructions received from the military over available ATC frequencies. Depending on instructions received from the military, VFR flights may be directed to land at the nearest available airport, and IFR flights will be expected to proceed as directed by ATC.

(4) Pilots on the ground may be required to file a flight plan and obtain an approval (through FAA) prior to conducting flight operation.

(5) In view of the above, all pilots should guard an ATC or FSS frequency at all times while conducting flight operations.

431. INTERCEPTION PROCEDURES

a. General

(1) Identification intercepts during peacetime operations are vastly different than those conducted under increased states of readiness. Unless otherwise directed by the control agency, intercepted aircraft will be identified by type only. When specific information is required (i.e. markings, serial numbers, etc.) the interceptor aircrew will respond only if the request can be conducted in a safe manner. During hours of darkness or Instrument Meteorological Conditions (IMC), identification of unknown aircraft will be by type only. The interception pattern described below is the typical peacetime method used by air interceptor aircrews. In all situations, the interceptor aircrew will use caution to avoid startling the intercepted aircrew and/or passengers.

b. Intercept phases

(1) Phase One — Approach Phase: During peacetime, intercepted aircraft will be approached from the stern. Generally two interceptor aircraft will be employed to accomplish the identification. The flight leader and his wingman will coordinate their individual positions in conjunction with the ground controlling agency. Their rela-

tionship will resemble a line abreast formation. At night or in IMC, a comfortable radar trail tactic will be used. Safe vertical separation between interceptor aircraft and unknown aircraft will be maintained at all times.

(2) Phase Two — Identification Phase: The intercepted aircraft should expect to visually acquire the lead interceptor and possibly the wingman during this phase in visual meteorological conditions (VMC). The wingman will assume a surveillance position while the flight leader approaches the unknown aircraft. Intercepted aircraft personnel may observe the use of different drag devices to allow for speed and position stabilization during this phase. The flight leader will then initiate a gentle closure toward the intercepted aircraft, stopping at a distance no closer than absolutely necessary to obtain the information needed. The interceptor aircraft will use every possible precaution to avoid startling intercepted aircrew or passengers. Additionally, the interceptor aircrews will constantly keep in mind that maneuvers considered normal to a fighter aircraft may be considered hazardous to passengers and crews of nonfighter aircraft. When interceptor aircrews know or believe that an unsafe condition exists, the identification phase will be terminated. As previously stated, during darkness or IMC identification of unknown aircraft will be by type only. Positive vertical separation will be maintained by interceptor aircraft throughout this phase.

(3) Phase Three — Post Intercept Phase: Upon identification phase completion, the flight leader will turn away from the intercepted aircraft. The wingman will remain well clear and accomplish a rejoin with his leader.

c. Communication interface between interceptor aircrews and the ground controlling agency is essential to ensure successful intercept completion. Flight Safety is paramount. An aircraft which is intercepted by another aircraft shall immediately:

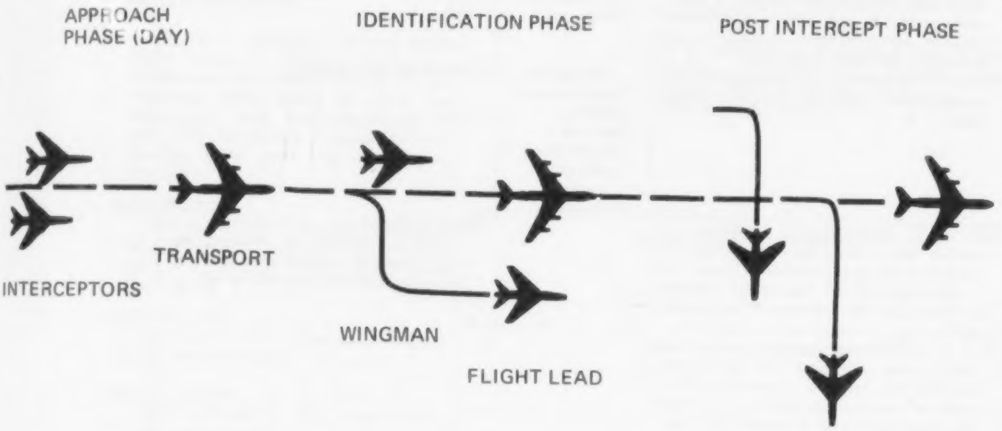
(1) Follow the instructions given by the intercepting aircraft, interpreting and responding to the visual signals.

(2) Notify, if possible, the appropriate air traffic services unit.

(3) Attempt to establish radio communication with the intercepting aircraft or with the appropriate intercept control unit, by making a general call on the emergency frequency 243.0 MHz and repeating this call on the emergency frequency 121.5 MHz, if practicable, giving the identity and position of the aircraft and the nature of the flight.

(4) If equipped with SSR transponder, select MODE 3/A Code 7700, unless otherwise instructed by the appropriate air traffic services unit. If any instructions received by radio from any sources conflict with those given by the intercepting aircraft by visual or radio signals, the intercepted aircraft shall request immediate clarification while continuing to comply with the instructions given by the intercepting aircraft.

INTERCEPTION PATTERNS
FOR IDENTIFICATION OF
INTERCEPTED AIRCRAFT
(TYPICAL)


APPROACH PHASE (DAY)
IDENTIFICATION PHASE
POST INTERCEPT PHASE
TRANSPORT
INTERCEPTORS
WINGMAN
FLIGHT LEAD

Note: During Night/IMC, approach will be from below flight path.

432. INTERCEPTION SIGNALS

INTERCEPTION SIGNALS

Signals initiated by intercepting aircraft and responses by intercepted aircraft (as set forth in ICAO Annex 2 — Appendix A, 2.1)

Series	INTERCEPTING Aircraft Signals	Meaning	INTERCEPTED Aircraft Responds	Meaning
1	DAY — Rocking wings from a position in front and, normally, to the left of intercepted aircraft and, after acknowledgement, a slow level turn, normally to the left, on to the desired heading. NIGHT — Same and, in addition, flashing navigational lights at irregular intervals. *Note 1. — Meteorological conditions or terrain may require the intercepting aircraft to take up a position in front and to the right of the intercepted aircraft and to make the subsequent turn to the right.* *Note 2. — If the intercepted aircraft is not able to keep pace with the intercepting aircraft, the latter is expected to fly a series of race-track patterns and to rock its wings each time it passes the intercepted aircraft.*	You have been intercepted. Follow me. NIGHT — Same and, in addition, flashing navigational lights at irregular intervals.	AEROPLANES: DAY — Rocking wings and following. Understood, will comply. HELICOPTERS: DAY or NIGHT — Rocking aircraft, flashing navigational lights at irregular intervals and following.	
2	DAY or NIGHT — An abrupt break-away manoeuvre from the intercepted aircraft consisting of a climbing turn of 90 degrees or more without crossing the line of flight of the intercepted aircraft.	You may proceed.	AEROPLANES: DAY or NIGHT — Rocking wings. HELICOPTERS: DAY or NIGHT — Rocking aircraft.	Understood, will comply.
3	DAY — Circling aerodrome, lowering landing gear and overflying runway in direction of landing or, if the intercepted aircraft is a helicopter, overflying the helicopter landing area. NIGHT — Same and, in addition, showing steady landing lights.	Land at this aerodrome.	AEROPLANES: DAY — Lowering landing gear, following the intercepted aircraft and, if after overflying the runway landing is considered safe, proceeding to land. NIGHT — Same and, in addition, showing steady landing lights (if carried). HELICOPTERS: DAY or NIGHT — Following the intercepting aircraft and proceeding to land, showing a steady landing light (if carried).	Understood, will comply.

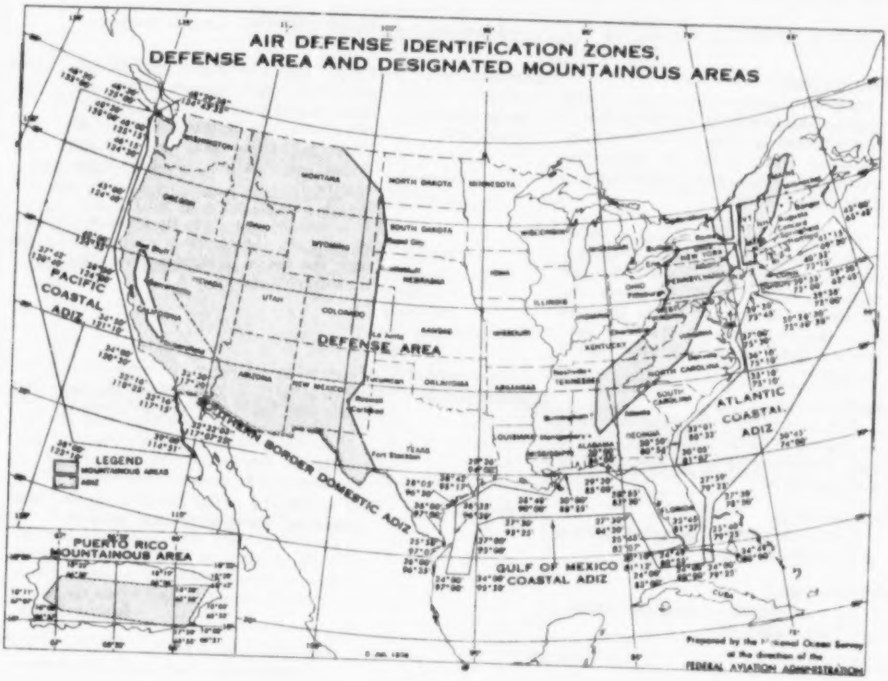
INTERCEPTION SIGNALS

Signals and Responses During Aircraft Intercept

Signals initiated by intercepted aircraft and responses by intercepting aircraft (as set forth in ICAO Annex 2 — Appendix A, 2.2)

Series	INTERCEPTED Aircraft Signals	Meaning	INTERCEPTING Aircraft Responds	Meaning
4	AEROPLANES: DAY — Raising landing gear while passing over landing runway at a height exceeding 300m (1,000 ft) but not exceeding 600m (2,000 ft) above the aerodrome level, and continuing to circle the aerodrome. NIGHT — Flashing landing lights while passing over landing runway at a height exceeding 300m (1,000 ft) but not exceeding 600m (2,000 ft) above the aerodrome level, and continuing to circle the aerodrome. If unable to flash landing lights, flash any other lights available.	Aerodrome you have designated is inadequate.	DAY or NIGHT — If it is desired that the intercepted aircraft follow the intercepting aircraft to an alternate aerodrome, the intercepting aircraft raises its landing gear and uses the Series 1 signals prescribed for intercepting aircraft. If it is decided to release the intercepted aircraft, the intercepting aircraft uses the Series 2 signals prescribed for intercepting aircraft.	Understood, follow me. Understood, you may proceed.
5	AEROPLANES: DAY or NIGHT — Regular switching on and off of all available lights but in such a manner as to be distinct from flashing lights.	Cannot comply.	DAY or NIGHT — Use Series 2 signals prescribed for intercepting aircraft.	Understood.
6	AEROPLANES: DAY or NIGHT — Irregular flashing of all available lights. HELICOPTERS: DAY or NIGHT — Irregular flashing of all available lights.	In distress.	DAY or NIGHT — Use Series 2 signals prescribed for intercepting aircraft.	Understood.

433. ADIZ BOUNDARIES AND DESIGNATED MOUNTAINOUS AREAS


AIR DEFENSE IDENTIFICATION ZONES,
DEFENSE AREA AND DESIGNATED MOUNTAINOUS AREAS
PACIFIC COASTAL ADIZ
DEFENSE AREA
SOUTHERN BORDER DOMESTIC ADIZ
ATLANTIC COASTAL ADIZ
GULF OF MEXICO COASTAL ADIZ
PUERTO RICO MOUNTAINOUS AREA
LEGEND
MOUNTAINOUS AREAS
ADIZ
Prepared by the National Ocean Survey at the direction of the FEDERAL AVIATION ADMINISTRATION

434—439. RESERVED

Chapter 5. EMERGENCY PROCEDURES

Section 1. GENERAL

440. PILOT RESPONSIBILITY AND AUTHORITY

a. The pilot in command of an aircraft is directly responsible for and is the final authority as to the operation of that aircraft. In an emergency requiring immediate action, the pilot in command may deviate from any rule in the FAR, Subpart A, General, and Subpart B, Flight Rules, to the extent required to meet that emergency. (FAR—91.3(b).)

b. If the emergency authority of FAR 91.3.(b) is used to deviate from the provisions of an ATC clearance, the pilot in command must notify ATC as soon as possible and obtain an amended clearance.

c. Unless deviation is necessary under the emergency authority of FAR—91.3, pilots of IFR flights experiencing two-way radio communications failure are expected to adhere to the procedures prescribed under "IFR operations, two-way radio communications failure." (FAR—91.127)

441. EMERGENCY CONDITION - REQUEST ASSISTANCE IMMEDIATELY

a. An emergency can be either a *distress* or *urgency* condition as defined in the Pilot/Controller Glossary. Pilots do not hesitate to declare an emergency when they are faced with *distress* conditions such as fire, mechanical failure, or structural damage. However, some are reluctant to report an *urgency* condition when they encounter situations which may not be immediately perilous, but are potentially catastrophic. An aircraft is in at least an *urgency* condition the moment the pilot becomes doubtful about position, fuel endurance, weather, or any other condition that could adversely affect flight safety. This is the time to ask for help, not after the situation has developed into a *distress* condition.

b. Pilots who become apprehensive for their safety for *any* reason should *request assistance immediately*. Ready and willing help is available in the form of radio, radar, direction finding stations and other aircraft. Delay has caused accidents and cost lives. *Safety is not a luxury! Take action!*

442—449. RESERVED

NOTES

Section 2. EMERGENCY SERVICES AVAILABLE TO PILOTS

450. RADAR SERVICE FOR VFR AIRCRAFT IN DIFFICULTY

a. Radar equipped ATC facilities can provide radar assistance and navigation service (vectors) to VFR aircraft in difficulty when the pilot can talk with the controller, and the aircraft is within radar coverage. Pilots should clearly understand that authorization to proceed in accordance with such radar navigational assistance does not constitute authorization for the pilot to violate FARs. In effect, assistance is provided on the basis that navigational guidance information is advisory in nature, and the responsibility for flying the aircraft safely remains with the pilot.

b. Experience has shown that many pilots who are not qualified for instrument flight cannot maintain control of their aircraft when they encounter clouds or other reduced visibility conditions. In many cases, the controller will not know whether flight into instrument conditions will result from his instructions. To avoid possible hazards resulting from being vectored into IFR conditions, a pilot in difficulty should keep the controller advised of the weather conditions in which he is operating and the weather along the course ahead and observe the following:

(1) If a course of action is available which will permit flight and a safe landing in VFR weather conditions, noninstrument rated pilots should choose the VFR condition rather than requesting a vector or approach that will take them into IFR weather conditions; or

(2) If continued flight in VFR conditions is not possible, the noninstrument rated pilot should so advise the controller and indicating the lack of an instrument rating, declare a *distress* condition, or

(3) If the pilot is instrument rated and current, and the aircraft is instrument equipped, the pilot should so indicate by requesting an IFR flight clearance. Assistance will then be provided on the basis that the aircraft can operate safely in IFR weather conditions.

451. TRANSPONDER EMERGENCY OPERATION

a. When a *distress* or *urgency* condition is encountered, the pilot of an aircraft with a coded radar beacon transponder, who desires to alert a ground radar facility, should squawk MODE 3/A, Code 7700/Emergency and MODE C altitude reporting and then immediately establish communications with the ATC facility.

b. Radar facilities are equipped so that Code 7700 normally triggers an alarm or special indicator at all control positions. Pilots should understand that they might not be within a radar coverage area. Therefore, they should continue squawking Code 7700 and establish radio communications as soon as possible.

452. DIRECTION FINDING INSTRUMENT APPROACH PROCEDURE

a. DF equipment has long been used to locate lost aircraft and to guide aircraft to areas of good weather or to airports. Now at most DF equipped airports, DF instrument approaches may be given to aircraft in a *distress* or *urgency* condition.

b. Experience has shown that most emergencies requiring DF assistance involve pilots with little flight experience. With this in mind, DF approach procedures provide maximum flight stability in the approach by using small turns, and wings-level descents. The DF specialist will give the pilot headings to fly and tell the pilot when to begin descent.

c. DF IAPs are for emergency use only and will not be used in IFR weather conditions unless the pilot has declared a *distress* or *urgency* condition.

d. To become familiar with the procedures and other benefits of DF, pilots are urged to request practice DF guidance and approaches in VFR weather conditions. DF specialists welcome the practice and will honor such requests, workload permitting.

453. INTERCEPT AND ESCORT

a. The concept of airborne intercept and escort is based on the Search and Rescue (SAR) aircraft establishing visual and/or electronic contact with an aircraft in difficulty, providing in-flight assistance, and escorting it to a safe landing. If bailout, crash landing or ditching becomes necessary, SAR operations can be conducted without delay. For most incidents, particularly those occurring at night and/or during instrument flight conditions, the availability of intercept and escort services will depend on the proximity of SAR units with suitable aircraft on alert for immediate dispatch. In limited circumstances, other aircraft flying in the vicinity of an aircraft in difficulty can provide these services.

b. If specifically requested by a pilot in difficulty or if a *distress* condition is declared, SAR coordinators *will* take steps to intercept and escort an aircraft. Steps *may* be initiated for intercept and escort if an *urgency* condition is declared and unusual circumstances make such action advisable.

c. It is the pilot's prerogative to refuse intercept and escort services. Escort services will normally be provided to the nearest adequate airport. Should the pilot receiving escort services continue onto another location after reaching a safe airport, or decide not to divert to the nearest safe airport, the escort aircraft is not obligated to continue and further escort is discretionary. The decision will depend on the circumstances of the individual incident.

454. EMERGENCY LOCATOR TRANSMITTERS

a. GENERAL. Emergency Locator Transmitters (ELTS) are required for most general aviation airplanes (FAR—91.52). ELTs of various types have been developed as a means of locating downed aircraft. These electronic, battery operated transmitters emit a distinctive downward swept audio tone on 121.5 MHz and 243.0 MHz. If "armed" and when subject to crash generated forces they are designed to automatically activate and continuously emit these signals. The transmitters will operate continuously for at least 48 hours over a wide temperature range. A properly installed and maintained ELT can expedite search and rescue operations and save lives.

b. TESTING. ELTs should be tested in accordance with the manufacturer's instructions, preferably in a shielded or screened room to prevent the broadcast of signals which could trigger a false alert. When this cannot be done, aircraft operational testing is authorized on 121.5 MHz and 243.0 MHz as follows:

(1) Tests should be conducted only during the first 5 minutes after any hour. If operational tests must be made outside of this time-frame, they should be coordinated with the nearest FAA Control Tower or FSS.

(2) Tests should be no longer than three audible sweeps.

(3) If the antenna is removable, a dummy load should be substituted during test procedures.

(4) Airborne tests are not authorized.

c. FALSE ALARMS. Caution should be exercised to prevent the inadvertent activation of ELTs in the air or while they are being handled on the ground. Accidental or unauthorized activation will generate an emergency signal that cannot be distinguished from the real thing, leading to expensive and frustrating searches. A false ELT signal could also interfere with genuine emergency transmissions and hinder or prevent the timely location of crash sites. Frequent false alarms could also result in complacency and decrease the vigorous reaction that must be attached to all ELT signals. Numerous cases of inadvertent activation have occurred as a result of aerobatics, hard landings, movement by ground crews and aircraft maintenance. These false alarms can be minimized by monitoring 121.5 MHz and/or 243.0 MHz as follows:

(1) In flight when a receiver is available.

(2) Prior to engine shut down at the end of e flight.

(3) When the ELT is handled during installation maintenance.

(4) When maintenance is being performed in the cinity of the ELT.

(5) When the aircraft is moved by a ground crew.

(6) If an ELT signal is heard, turn off the ELT to d termine if it is transmitting. If it has been activated, mai tenance might be required before the unit is returned the "ARMED" position.

d. IN-FLIGHT MONITORING AND REPORTIN Pilots are encouraged to monitor 121.5 MHz and/or 243 MHz while in-flight to assist in identifying possible emer gency ELT transmissions. On receiving a signal, report th following information to the nearest air traffic facility:

(1) Your position at the time the signal was fir heard.

(2) Your position at the time the signal was la heard.

(3) Your position at maximum signal strength.

(4) Your flight altitudes and frequency on which the emergency signal was heard - 121.5 MHz or 243.0 MHz. I possible, positions should be given relative to a navigatio aid. If the aircraft has homing equipment, provide the bearing to the emergency signal with each reported pos tion.

455. FAA SPONSORED EXPLOSIVES DETECTION (DOG/HANDLER TEAM) LOCATIONS

a. At many of our major airports a program has bee established by the FAA to make available explosives dete tion dog/handler teams. The dogs are trained by the Ai Force and the overall program is run by FAA's Office o Civil Aviation Security. Local police departments are the caretakers of the dogs and are allowed to use the dogs i their normal police patrol functions. The local airport however, has first call on the teams' services. The expl sives detection teams were established so that no aircra in flight is more than 1 hour from an airport at which i can be searched if a bomb threat is received. The following list contains those locations that presently have a team i existence. This list will be updated as more teams are e tablished. If you desire this service, notify your company o an FAA facility.

b. Team Locations:

Airport Symbol	Location
ATL	Atlanta, Georgia
BWI	Baltimore, Maryland
BHM	Birmingham, Alabama
BIS	Bismarck, North Dakota
BOS	Boston, Massachusetts
BUF	Buffalo, New York
ORD	Chicago, Illinois
CLE	Cleveland, Ohio
DFW	Dallas, Texas
IAH	Houston, Texas
JAX	Jacksonville, Florida
MCI	Kansas City, Missouri

Airport Symbol	Location
LAX	Los Angeles, California
MEM	Memphis, Tennessee
MIA	Miami, Florida
MSY	New Orleans, Louisiana
PHX	Phoenix, Arizona
PIT	Pittsburgh, Pennsylvania
PDX	Portland, Oregon
SLC	Salt Lake City, Utah
SAN	San Diego, California
SFO	San Francisco, California
SJU	San Juan, Puerto Rico
SEA	Seattle, Washington
GEG	Spokane, Washington
STL	St. Louis, Missouri
TUS	Tucson, Arizona
TUL	Tulsa, Oklahoma

c. If due to weather or other considerations an aircraft with a suspected hidden explosive problem were to land or intended to land at an airport other than those listed in b. above, it is recommended that they call the FAA's Washington Operations Center (telephone 202-426-3333, if appropriate) or have an air traffic facility with which you can communicate contact the above center requesting assistance.

456. SEARCH AND RESCUE

a. GENERAL. SAR is a lifesaving service provided through the combined efforts of the federal agencies signatory to the National SAR Plan, and the agencies responsible for SAR within each state. Operational resources are provided by the U.S. Coast Guard, DOD components, the Civil Air Patrol, the Coast Guard Auxiliary, state, county and local law enforcement and other public safety agencies, and private volunteer organizations. Services include search for missing aircraft, survival aid, rescue, and emergency medical help for the occupants after an accident site is located.

b. NATIONAL SEARCH AND RESCUE PLAN. By federal interagency agreement, the National Search and Rescue Plan provides for the effective use of all available facilities in all types of SAR missions. These facilities include aircraft, vessels, pararescue and ground rescue teams, and emergency radio fixing. Under the Plan, the U.S. Coast Guard is responsible for the coordination of SAR in the Maritime Region, and the USAF is responsible in the Inland Region. To carry out these responsibilities, the Coast Guard and the Air Force have established Rescue Coordination Centers (RCCs) to direct SAR activities within their Regions. For aircraft emergencies, distress and urgency information normally will be passed to the appropriate RCC through an ARTCC or FSS.

c. COAST GUARD RESCUE COORDINATION CENTERS

Boston, MA
617-223-3644
New York, NY
212-668-7055
Long Beach, CA
213-590-2225
San Francisco, CA
415-437-3700
Portsmouth, VA
804-398-6231
Miami, FL
305-350-5611
New Orleans, LA
504-589-6225
Cleveland, OH
216-522-3984
St. Louis, MO
314-425-4614
Seattle, WA
206-442-5886
Juneau, AK
907-586-7340
Honolulu, HI
808-546-7109
Kodiak, AK
907-487-5888
San Juan, Puerto Rico
809-722-2943

d. AIR FORCE RESCUE COORDINATION CENTERS

Air Force Rescue Coordination Center - 48 Contiguous States

Scott AFB, Illinois	PHONE
Commercial	618-256-4815
WATS	800-851-3051
AUTOVON	638-4815
FTS	255-4815 or 4810

Alaskan Air Command Rescue Coordination Center - Alaska

Elmendorf AFB, Alaska	PHONE
Commercial	907-552-5375
AUTOVON	552-5375 or 2426

e. JOINT RESCUE COORDINATION CENTERS

Honolulu Joint Rescue Coordination Center - Hawaii

HQ 14th Coast Guard District Honolulu.	PHONE
Commercial	808-531-1112
AUTOVON	315-421-4845

f. OVERDUE AIRCRAFT.

(1) ARTCCs and FSSs will alert the SAR system when information is received from any source that an aircraft is in difficulty, overdue, or missing. *A filed flight plan is the most timely and effective indicator that an air-*

craft is overdue. Flight plan information is invaluable to SAR forces for search planning and executing search efforts.

(2) Prior to departure on every flight, local or otherwise, someone at the departure point should be advised of your destination and route of flight if other than direct. Search efforts are often wasted and rescue is often delayed because of pilots who thoughtlessly takeoff without telling anyone where they are going. File a flight plan for *your* safety.

(3) According to the National Search and Rescue Plan, "The life expectancy of an injured survivor decreases as much as 80 percent during the first 24 hours, while the chances of survival of uninjured survivors rapidly diminishes after the first 3 days."

(4) An Air Force Review of 325 SAR missions conducted during a 23-month period revealed that "Time works against people who experience a *distress* but are not on a flight plan, since 36 hours normally pass before family concern initiates an (alert)."

g.VFR SEARCH AND RESCUE PROTECTION.

(1) To receive this valuable protection, *file a VFR Flight Plan* with an FAA FSS. For maximum protection, file only to the point of first intended landing, and refile for each leg to final destination. When a lengthy flight plan is filed, with several stops en route and an ETE to final destination, a mishap could occur on any leg, and unless other information is received, it is probably that no one would start looking for you until 30 minutes after your ETA at your final destination.

(2) If you land at a location other than the intended destination, report the landing to the nearest FAA FSS and advise them of your original destination.

(3) If you land en route and are delayed more than 30 minutes, report this information to the nearest FSS and give them your original destination.

(4) If your ETE changes by 30 minutes or more, report a revised ETE to the nearest FSS and give them your original destination. Remember that if you fail to report within one-half hour after your ETA at final destination, a search will be started to locate you.

(5) It is important that you *close your flight plan IMMEDIATELY AFTER ARRIVAL AT YOUR FINAL DESTINATION WITH THE FSS DESIGNATED WHEN YOUR FLIGHT PLAN WAS FILED. The pilot is responsible for closure of a VFR flight plan; they are not closed automatically.* This will prevent needless search efforts.

(6) The rapidity of rescue on land or water will depend on how accurately your position may be determined. If a flight plan has been followed and your position is on course, rescue will be expedited.

h.SURVIVAL EQUIPMENT.

(1) For flight over uninhabited land areas, it is wise to take and know how to use survival equipment for the type of climate and terrain.

(2) If a forced landing occurs at sea, chances for survival are governed by the degree of crew proficiency in emergency procedures and by the availability and effectiveness of water survival equipment.

i.OBSERVANCE OF DOWNED AIRCRAFT.

(1) Determine if crash is marked with a yellow cross; if so, the crash has already been reported and identified.

(2) If possible, determine type and number of aircraft and whether there is evidence of survivors.

(3) Fix the position of the crash as accurately as possible with reference to a navigational aid. If possible provide geographic or physical description of the area to aid ground search parties.

(4) Transmit the information to the nearest FAA or other appropriate radio facility.

(5) If circumstances permit, orbit the scene to guide in other assisting units until their arrival or until you are relieved by another aircraft.

(6) Immediately after landing, make a complete report to the nearest FAA facility, or Air Force or Coast Guard Rescue Coordination Center. The report can be made by long distance collect telephone.

457—459. RESERVED

GROUND-AIR VISUAL CODE FOR USE BY SURVIVORS

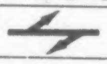
NO.	MESSAGE	CODE SYMBOL
1	Require assistance	V
2	Require medical assistance	X
3	No or Negative	N
4	Yes or Affirmative	Y
5	Proceeding in this direction	↑

IF IN DOUBT, USE INTERNATIONAL SYMBOL **SOS**

INSTRUCTIONS

1. Lay out symbols by using strips of fabric or parachutes, pieces of wood, stones, or any available material.
2. Provide as much color contrast as possible between material used for symbols and background against which symbols are exposed.
3. Symbols should be at least 10 feet high or larger. Care should be taken to lay out symbols exactly as shown.
4. In addition to using symbols, every effort is to be made to attract attention by means of radio, flares, smoke, or other available means.
5. On snow covered ground, signals can be made by dragging, shoveling or tramping. Depressed areas forming symbols will appear black from the air.
6. Pilot should acknowledge message by rocking wings from side to side.

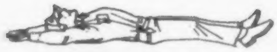
GROUND-AIR VISUAL CODE FOR USE BY GROUND SEARCH PARTIES

NO.	MESSAGE	CODE SYMBOL
1	Operation completed.	LLL
2	We have found all personnel.	$\underline{LL}$
3	We have found only some personnel.	++
4	We are not able to continue. Returning to base.	XX
5	Have divided into two groups. Each proceeding in direction indicated.	
6	Information received that aircraft is in this direction.	— →
7	Nothing found. Will continue search.	NN

ote: These visual signals have been accepted for international use and appear in Annex 12 to the Convention on International Civil Aviation."

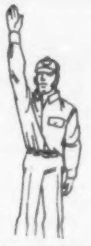
EMERGENCY SERVICES AVAILABLE TO PILOTS

VISUAL EMERGENCY SIGNALS



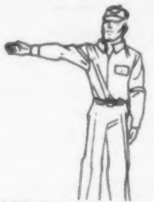
NEED MEDICAL ASSISTANCE—URGENT

Used only when life is at stake



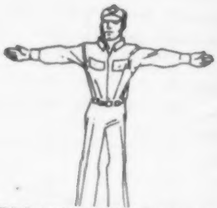
ALL OK—DO NOT WAIT

Wave one arm overhead



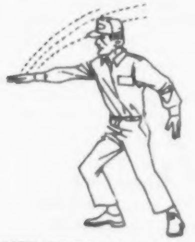
CAN PROCEED SHORTLY—WAIT IF PRACTICABLE

One arm horizontal



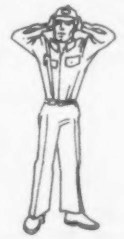
NEED MECHANICAL HELP OR PARTS—LONG DELAY

Both arms horizontal



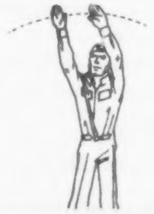
USE DROP MESSAGE

Make throwing motion



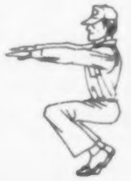
OUR RECEIVER IS OPERATING

Cup hands over ears



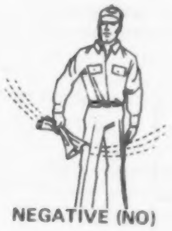
DO NOT ATTEMPT TO LAND HERE

Both arms waved across face



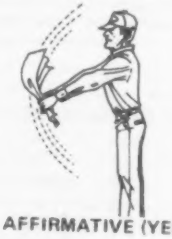
LAND HERE

Both arms forward horizontally, squatting and point in direction of landing—Repeat



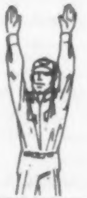
NEGATIVE (NO)

White cloth waved horizontally



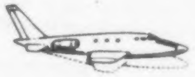
AFFIRMATIVE (YES)

White cloth waved vertically



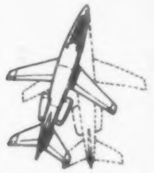
PICK US UP—PLANE ABANDONED

Both arms vertical



AFFIRMATIVE (YES)

Dip nose of plane several times



NEGATIVE (NO)

Fishtail plane

HOW TO USE THEM

If you are forced down and are able to attract the attention of the pilot of a rescue airplane, the body signals illustrated on this page can be used to transmit messages to him as he circles over your location. Stand in the open when you make the signals. Be sure that the background, as seen from the air, is not confusing. Go through the motions slowly and repeat each signal until you are positive that the pilot understands you.

Section 3. DISTRESS AND URGENCY PROCEDURES

460. DISTRESS AND URGENCY COMMUNICATIONS

a. A pilot who encounters a *distress* or *urgency* condition can obtain assistance simply by contacting the air traffic facility or other agency in whose area of responsibility the aircraft is operating, stating the nature of the difficulty, pilot's intentions and assistance desires. *Distress* and *urgency* communications procedures are prescribed by the International Civil Aviation Organization (ICAO), however, and have decided advantages over the informal procedure described above.

b. *Distress* and *urgency* communications procedures discussed in the following paragraphs relate to the use of air ground voice communications.

c. The initial communication, and if considered necessary, any subsequent transmissions by an aircraft in *distress* should begin with the signal MAYDAY, preferably repeated three times. The signal PAN-PAN should be used in the same manner for an *urgency* condition.

d. *Distress* communications have absolute priority over all other communications, and the word MAYDAY commands radio silence on the frequency in use. *Urgency* communications have priority over all other communications except *distress*, and the word PAN-PAN warns other stations not to interfere with *urgency* transmissions.

e. Normally, the station addressed will be the air traffic facility or other agency providing air traffic services, on the frequency in use at the time. If the pilot is not communicating and receiving services, the station to be called will normally be the air traffic facility or other agency in whose area of responsibility the aircraft is operating, on the appropriate assigned frequency. If the station addressed does not respond, or if time or the situation dictates, the *distress* or *urgency* message may be broadcast, or a collect call may be used, addressing "Any Station (Tower)(Radio)(Radar)."

f. The station addressed should immediately acknowledge a *distress* or *urgency* message, provide assistance, coordinate and direct the activities of assisting facilities, and alert the appropriate search and rescue coordinator if warranted. Responsibility will be transferred to another station only if better handling will result.

g. All other stations, aircraft and ground, will continue to listen until it is evident that assistance is being provided. If any station becomes aware that the station being called either has not received a *distress* or *urgency* message, or cannot communicate with the aircraft in difficulty, it will attempt to contact the aircraft and provide assistance.

h. Although the frequency in use or other frequencies assigned by ATC are preferable, the following emergency frequencies can be used for distress or urgency communications, if necessary or desirable:

(1) 121.5 MHz and 243.0 MHz - Both have a range generally limited to line of sight. 121.5 MHz is guarded by direction finding stations and some military and civil aircraft. 243.0 MHz is guarded by military aircraft. Both 121.5 MHz and 243.0 MHz are guarded by military towers, most civil towers, FSSs, and radar facilities. Normally ARTCC emergency frequency capability does not extend to radar coverage limits. If an ARTCC does not respond when called on 121.5 MHz or 243.0 MHz, call the nearest tower or FSS.

(2) 2182 kHz - The range is generally less than 300 miles for the average aircraft installation. It can be used to request assistance from stations in the maritime service. 2182 kHz is guarded by major radio stations serving Coast Guard Rescue Coordination Centers, and Coast Guard units along the sea coasts of the U.S. and shores of the Great Lakes. The call "Coast Guard" will alert all Coast Guard Radio Stations within range. 2182 kHz is also guarded by most commercial coast stations and some ships and boats.

461. OBTAINING EMERGENCY ASSISTANCE

a. A pilot in any *distress* or *urgency* condition should *immediately* take the following action, not necessarily in the order listed, to obtain assistance:

(1) Climb, if possible, for improved communications, and better radar and direction finding detection. However, it must be understood that unauthorized climb or descent under IFR conditions within controlled airspace is prohibited, except as permitted by FAR—91.3(b).

(2) If equipped with a radar beacon transponder (civil) or IFF/SIF (military):

(a) Continue squawking assigned MODE A/3 discrete code/VFR code and MODE C altitude encoding when in radio contact with an air traffic facility or other agency providing air traffic services, unless instructed to do otherwise.

(b) If unable to immediately establish communications with an air traffic facility/agency, squawk MODE A/3, Code 7700/Emergency and MODE C.

(3) Transmit a *distress* or *urgency* message consisting of *as many as necessary* of the following elements, preferably in the order listed:

(a) If distress, MAYDAY, MAYDAY, MAYDAY; if *urgency*, PAN-PAN, PAN-PAN, PAN-PAN.

(b) Name of station addressed.

(c) Aircraft identification and type.

(d) Nature of *distress* or *urgency*.

(e) Weather.

(f) Pilots intentions and request.

(g) Present position, and heading, or if *lost*, last known position, time, and heading since that position.

(h) Altitude or flight level.

(i) Fuel remaining in hours and minutes.

(j) Number of people on board.

(k) Any other useful information.

b. After establishing radio contact, comply with advice and instructions received. Cooperate. Do not hesitate to ask questions or clarify instructions when you do not understand or if you cannot comply with clearance. Assist the ground station to control communications on the frequency in use. Silence interfering radio stations. Do not change frequency or change to another ground station unless absolutely necessary. If you do, advise the ground station of the new frequency and station name prior to the change, transmitting in the blind if necessary. If two-way communications cannot be established on the new frequency, return immediately to the frequency or station where two-way communications last existed.

c. When in a distress condition with bailout, crash landing or ditching imminent, take the following additional actions to assist search and rescue units:

(1) Time and circumstances permitting, transmit as many as necessary of the message elements in PARA—461a(3) and any of the following that you think might be helpful

(a) ELT status.

(b) Visible landmarks.

(c) Aircraft color.

(d) Number of persons on board.

(e) Emergency equipment on board.

(2) **G2**Actuate your ELT if the installation permits.

(3) For bailout, and for crash landing or ditching if risk of fire is not a consideration, set your radio for continuous transmission.

(4) If it becomes necessary to ditch, make every effort to ditch near a surface vessel. If time permits, an FAA facility should be able to get the position of the nearest commercial or Coast Guard vessel from a Coast Guard Rescue Coordination Center.

(5) After a crash landing unless you have good reason to believe that you will not be located by search aircraft or ground teams, it is best to remain with your aircraft and prepare means for signalling search aircraft.

462. DITCHING PROCEDURES

a. A successful aircraft ditching is dependent on three primary factors. In order of importance they are:

(1) Sea conditions and wind.

(2) Type of aircraft.

(3) Skill and technique of pilot.

b. Common oceanographic terminology:

(1) Sea. The condition of the surface that is the result of both waves and swells.

(2) Wave (or Chop). The condition of the surface caused by the local winds.

(3) Swell. The condition of the surface which has been caused by a distance disturbance.

(4) Swell Face. The side of the swell toward the observer. The backside is the side away from the observer. These definitions apply regardless of the direction of swell movement.

(5) Primary Swell. The swell system having the greatest height from trough to crest.

(6) Secondary Swells. Those swell systems of less height than the primary swell.

(7) Fetch. The distance the waves have been driven by a wind blowing in a constant direction, without obstruction.

(8) Swell Period. The time interval between the passage of two successive crests at the same spot in the water, measured in seconds.

(9) Swell Velocity. The speed and direction of the swell with relation to a fixed reference point, measured in knots. There is little movement of water in the horizontal direction. Swells move primarily in a vertical motion, similar to the motion observed when shaking out a carpet.

(10) Swell Direction. The direction *from* which a swell is moving. This direction is not necessarily the result of the wind present at the scene. The swell may be moving into or across the local wind. Swells, once set in motion, tend to maintain their original direction for as long as they continue in deep water, regardless of changes in wind direction.

(11) Swell Height. The height between crest and trough, measured in feet. The vast majority of ocean swells are lower than 12 to 15 feet, and swells over 25 feet are not common at any spot on the oceans. Successive swells may differ considerably in height.

c. In order to select a good heading when ditching an aircraft, a basic evaluation of the sea is required. Selection of a good ditching heading may well minimize damage and could save your life. It can be extremely dangerous to land into the wind without regard to sea conditions; the swell system, or systems, must be taken into consideration. Remember one axiom - AVOID THE FACE OF A SWELL.

(1) In ditching parallel to the swell, it makes little difference whether touchdown is on the top of the crest or in the trough. It is preferable, however, to land on the top or back side of the swell, if possible. After determining which heading (and its reciprocal) will parallel the swell, select the heading with the most into the wind component.

(2) If only one swell system exists, the problem is relatively simple - even with a high, fast system. Unfortunately, most cases involve two or more swell systems running in different directions. With more than one system present, the sea presents a confused appearance. One of the most difficult situations occurs when two swell systems are at right angles. For example, if one system is eight feet high, and the other three feet, plan to land parallel to the primary system, and on the down swell of the secondary system. If both systems are of equal height, a compromise may be advisable - select an intermediate heading at 45 degrees down swell to both systems. When landing down a secondary swell, attempt to touch down on the back side, not on the face of the swell.

(3) *If the swell system is formidable, it is considered advisable, in landplanes, to accept more crosswind in order to avoid landing directly into the swell.*

(4) The secondary swell system is often from the same direction as the wind. Here, the landing may be made parallel to the primary system, with the wind and secondary system at an angle. There is a choice to two directions paralleling the primary system. One direction is downwind and down the secondary swell, and the other is into the wind and into the secondary swell, the choice will depend on the velocity of the wind versus the velocity and height of the secondary swell.

d. The simplest method of estimating the wind direction and velocity is to examine the windstreaks on the water. These appear as long streaks up and down wind

Some persons may have difficulty determining wind direction after seeing the streaks on the water. Whitecaps fall forward with the wind but are overrun by the waves thus producing the illusion that the foam is sliding backward. Knowing this, and by observing the direction of the streaks, the wind direction is easily determined. Wind velocity can be estimated by noting the appearance of the whitecaps, foam and wind streaks.

(1) The behavior of the aircraft on making contact with the water will vary within wide limits according to the state of the sea. If landed parallel to a single swell system, the behavior of the aircraft may approximate that to be expected on a smooth sea. If landed into a heavy swell or into a confused sea, the deceleration forces may be extremely great - resulting in breaking up of the aircraft. Within certain limits, the pilot is able to minimize these forces by proper sea evaluation and selection of ditching heading.

(2) When on final approach the pilot should look ahead and observe the surface of the sea. There may be shadows and whitecaps - signs of large seas. Shadows and whitecaps close together indicate short and rough seas. Touchdown in these areas is to be avoided. Select and touchdown in any area (only about 500 feet is needed) where the shadows and whitecaps are not so numerous.

(3) Touchdown should be at the *lowest* speed and rate of descent which permit safe handling and optimum nose up attitude on impact. Once first impact has been made, there is often little the pilot can do to control a landplane.

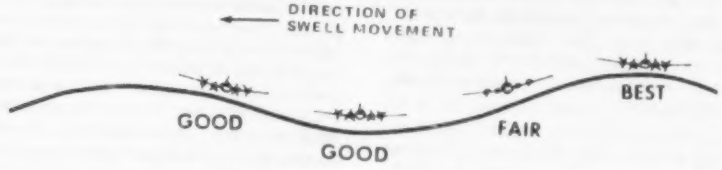
e. Once preditching preparations are completed, the pilot should turn to the ditching heading and commence let-down. The aircraft should be flown low over the water, and slowed down until ten knots or so above stall. At this point, additional power should be used to overcome the increased drag caused by the nose up attitude. When a smooth stretch of water appears ahead, cut power, and touchdown at the best recommended speed as fully stalled as possible. By cutting power when approaching a relatively smooth area, the pilot will prevent overshooting and will touchdown with less chance of planing off into a second uncontrolled landing. Most experienced seaplane pilots prefer to make contact with the water in a semi-stalled attitude, cutting power as the tail makes contact. This technique eliminates the chance of misjudging altitude with a resultant heavy drop in a fully stalled condition. Care must be taken not to drop the aircraft from too high altitude or to balloon due to excessive speed. The altitude above water depends on the aircraft. Over glassy smooth water, or at night without sufficient light, it is very easy, for even the most experienced pilots to misjudge altitude by 50 feet or more. Under such conditions, carry enough power to maintain nine to twelve degrees nose up attitude, and 10 to 20 percent over stalling speed until contact is made with the water. The proper use of power on the approach is of great importance. If power is available on one side only, a little power should be used to flatten the approach; however, the engine should not be used to such an extent that the aircraft cannot be turned against the good engines right down to the stall with a margin of rudder movement available. When near the stall, sudden application of excessive unbalanced power may result in loss of directional control. If power is available on one side only, a slightly higher than normal glide approach speed should be used. This will insure good control and some margin of speed after leveling off without excessive use of power. The use of power in ditching is so important that when it is certain that the coast cannot be reached, the pilot should, if possible, ditch before fuel is exhausted. The use of power in a night or instrument ditching is far more essential than under daylight contact conditions.

(1) If no power is available, a greater than normal approach speed should be used down to the flare-out. This speed margin will allow the glide to be broken early and more gradually, thereby giving the pilot time and distance to feel for the surface - decreasing the possibility of stalling high or flying into the water. When landing parallel to a swell system, little difference is noted between landing on top of a crest or in the trough. If the wings of aircraft are trimmed to the surface of the sea rather than the horizon, there is little need to worry about a wing hitting a swell crest. The actual slope of a swell is very gradual. If forced to land into a swell, touchdown should be made just after passage of the crest. If contact is made on the face of the swell, the aircraft may be swamped or thrown violently into the air, dropping heavily into the next swell. If control surfaces remain intact, the pilot should attempt to maintain the proper nose above the horizon attitude by rapid and positive use of the controls.

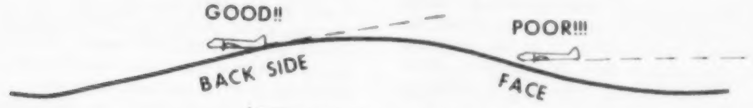
f. After Touchdown: In most cases drift, caused by crosswind can be ignored; the forces acting on the aircraft after touchdown are of such magnitude that drift will be only a secondary consideration. If the aircraft is under good control, the "crab" may be kicked out with rudder just prior to touchdown. This is more important with high wing aircraft, for they are laterally unstable on the water in a crosswind and may roll to the side in ditching.

NOTE.-- This information has been extracted from Appendix H of the "National Search And Rescue Manual."

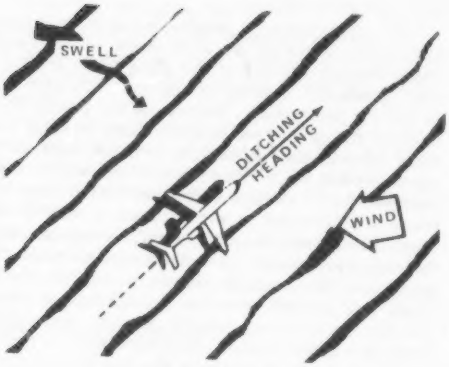
WIND-SWELL-DITCH HEADING SITUATIONS


DIRECTION OF SWELL MOVEMENT
GOOD
GOOD
FAIR
BEST

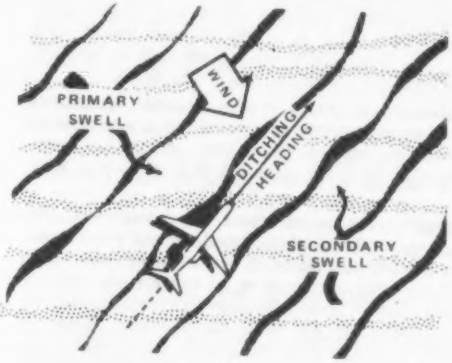
Landing parallel to the major swell


GOOD!!
POOR!!!
BACK SIDE
FACE

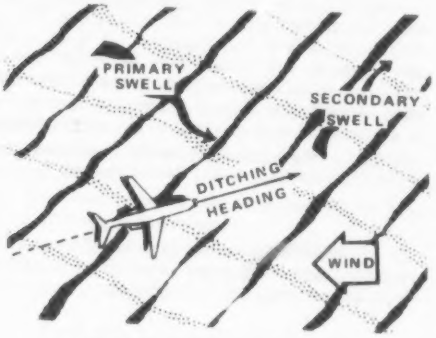
Landing on the face and back of swell


SWELL
DITCHING HEADING
WIND

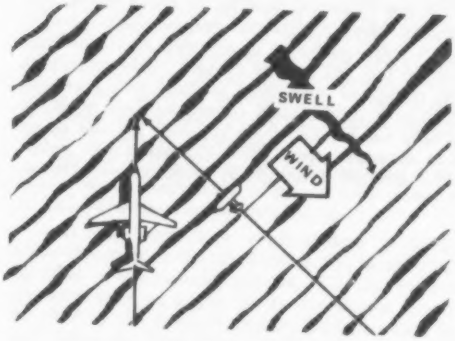
Single Swell System · Wind 15 knots


PRIMARY SWELL
WIND
DITCHING HEADING
SECONDARY SWELL

Double Swell System · Wind 15 knots


PRIMARY SWELL
SECONDARY SWELL
DITCHING HEADING
WIND

Double Swell System · Wind 30 knots



Wind · 50 knots

Aircraft with low landing speeds · land into the wind.

Aircraft with high landing speeds · choose compromise heading between wind and swell.

Both · Land on back side of swell.

463. SPECIAL EMERGENCY (AIR PIRACY)

a. A special emergency is a condition of air piracy, or other hostile act by a person(s) aboard an aircraft, which threatens the safety of the aircraft or its passengers.

b. The pilot of an aircraft reporting a special emergency condition should:

(1) If circumstances permit, apply *distress or urgency* radio-telephony procedures (see PARA—460). Include the details of the special emergency.

(2) If circumstances do not permit the use of prescribed *distress* or *urgency* procedures, transmit:

(a) On the air/ground frequency in use at the time.

(b) As many as possible of the following elements spoken distinctly and in the following order:

1.Name of the station addressed (time and circumstances permitting).

2.The identification of the aircraft and present position.

3.The nature of the special emergency condition and pilot intentions (circumstances permitting).

4.If unable to provide this information, use code words and/or transponder as follows: state "TRANSPONDER SEVEN FIVE ZERO ZERO". Meaning: "I am being hijacked/forced to a new destination"; and/or use Transponder Setting MODE 3/A, Code 7500.

NOTE.— Code 7500 will never be assigned by ATC without prior notification from the pilot that his aircraft is being subjected to unlawful interference. The pilot should refuse the assignment of Code 7500 in any other situation and inform the controller accordingly. Code 7500 will trigger the special emergency indicator in all radar ATC facilities.

c. Air traffic controllers will acknowledge and confirm receipt of transponder Code 7500 by asking the pilot to verify it. If the aircraft is not being subjected to unlawful interference, the pilot should respond to the query by broadcasting in the clear that he is not being subjected to unlawful interference. Upon receipt of this information, the controller will request the pilot to verify the code selection depicted in the code selector windows in the transponder control panel and change the code to the appropriate setting. If the pilot replies in the affirmative or does not reply, the controller will not ask further questions but will flight follow, respond to pilot requests and notify appropriate authorities.

d. If it is possible to do so without jeopardizing the safety of the flight, the pilot of a hijacked passenger aircraft, after departing from the cleared routing over which the aircraft was operating, will attempt to do one or more of the following things, insofar as circumstances may permit:

(1) Maintain a true airspeed of no more than 400 knots, and preferably an altitude of between 10,000 and 25,000 feet.

(2) Fly a course toward the destination which the hijacker has announced.

e. If these procedures result in either radio contact or air intercept, the pilot will attempt to comply with any instructions received which may direct him to an appropriate landing field.

464. FUEL DUMPING

a. Should it become necessary to dump fuel, the pilot should immediately advise ATC. Upon receipt of information that an aircraft will dump fuel, ATC will broadcast or cause to be broadcast immediately and every 3 minutes thereafter the following on appropriate ATC and FSS radio frequencies:

EXAMPLE:

ATTENTION ALL AIRCRAFT — FUEL DUMPING IN PROGRESS OVER — (location) AT (altitude) BY (type aircraft) (flight direction).

b. Upon receipt of such a broadcast, pilots of aircraft affected, which are not on IFR flight plans or special VFR clearances, should clear the area specified in the advisory. Aircraft on IFR flight plans or special VFR clearances will be provided specific separation by ATC. At the termination of the fuel dumping operation, pilots should advise ATC. Upon receipt of such information, ATC will issue, on the appropriate frequencies, the following:

EXAMPLE:

ATTENTION ALL AIRCRAFT — FUEL DUMPING BY — (type aircraft) — TERMINATED.

465—469. RESERVED

NOTES

Section 4. TWO-WAY RADIO COMMUNICATIONS FAILURE

470. TWO-WAY RADIO COMMUNICATIONS FAILURE

a. It is virtually impossible to provide regulations and procedures applicable to all possible situations associated with two-way radio communications failure. During two-way radio communications failure, when confronted by a situation not covered in the regulation, pilots are expected to exercise good judgment in whatever action they elect to take. Should the situation so dictate they should not be reluctant to use the emergency action contained in FAR—91.3(b).

b. Whether two-way communications failure constitutes an emergency depends on the circumstances, and in any event, it is a determination made by the pilot. FAR—91.3(b) authorizes a pilot to deviate from any rule in Subparts A and B to the extent required to meet an emergency.

c. In the event of two-way radio communications failure, ATC service will be provided on the basis that the pilot is operating in accordance with FAR—91.127. A pilot experiencing two-way communications failure should (unless emergency authority is exercised) comply with FAR—91.127 quoted below. Capitalization and examples added for emphasis.

1. "91.127 IFR operations; two-way radio communications failure."

(1) General. Unless otherwise authorized by ATC, each pilot who has two-way radio communications failure when operating under IFR shall comply with the rules of this section.

(2) VFR conditions. If the failure occurs in VFR conditions, or if VFR conditions are encountered after the failure, each pilot shall continue the flight under VFR and land as soon as practicable.

NOTE.— This procedure also applies when two-way radio failure occurs while operating in Positive Control Airspace (PCA). The primary objective of this provision in FAR—91.127 is to preclude extended IFR operation in the ATC system in VFR weather conditions. Pilots should recognize that operation under these conditions may unnecessarily as well as adversely affect other users of the airspace, since ATC may be required to reroute or delay other users in order to protect the failure aircraft. However, it is not intended that the requirement to "land as soon as practicable" be construed to mean "as soon as possible." The pilot retains his prerogative of exercising his best judgment and is not required to land at an unauthorized airport, at an airport unsuitable for the type of aircraft flown, or to land only minutes short of his destination.

(3) IFR conditions. If the failure occurs in IFR conditions, or if paragraph (b) of this section cannot be complied with, each pilot shall continue the flight according to the following:

(a) Route.

1. By the route assigned in the last ATC clearance received;

2. If being radar vectored, by the direct route from the point of radio failure to the fix, route, or airway specified in the vector clearance;

3. In the absence of an assigned route, by the route that ATC has advised may be expected in a further clearance; or

4. In the absence of an assigned route or a route that ATC has advised may be expected in a further clearance by the route filed in the flight plan.

(b) Altitude. At the HIGHEST of the following altitudes or flight levels FOR THE ROUTE SEGMENT BEING FLOWN:

1. The altitude or flight level assigned in the last ATC clearance received;

2. The minimum altitude (converted, if appropriate, to minimum flight level as prescribed in FAR 91.81(c)) for IFR operations; or

3. The altitude or flight level ATC has advised may be expected in a further clearance.

NOTE.— The intent of the rule is that a pilot who has experienced two-way radio failure should, during any segment of his route, fly at the appropriate altitude specified in the rule for that particular segment. The appropriate altitude is whichever of the three is highest in each given phase of flight: (1) the altitude or flight level last assigned; (2) the MEA or (3) the altitude or flight level the pilot has been advised to expect in a further clearance.

EXAMPLE:

A pilot with two-way radio failure had an assigned altitude of 7,000 feet, and while en route comes to a route segment for which the MEA was 9,000 feet. He would climb to 9,000 feet at the time or place where it became necessary to comply with the 9,000 feet MEA. (See FAR—91.119(b).) If later, while still proceeding to his destination, the MEA dropped from 9,000 feet to 5,000 feet, he would descend to *7,000 feet* (the last assigned altitude), because that altitude is *higher* than the MEA.

EXAMPLE:

The MEA between **A** and **B** —5,000 feet. The MEA between **B** and **C** —5,000 feet. The MEA between **C** and **D** —11,000 feet. The MEA between **D** and **E** —7,000 feet. A pilot had been cleared via **A**, **B**, **C**, **D**, to **E**. While flying between A and B his assigned altitude was 6,000 feet and he was told to expect a clearance to 8,000 feet at **B**. Prior to receiving the higher altitude assignment, he experienced two-way failure. The pilot would maintain 6,000 to **B**, then climb to 8,000 feet (the altitude he was advised to expect.) He would maintain 8,000 feet, then climb to 11,000 at **C**, or prior to **C** if necessary to comply with an MCA at **C**. (FAR—91.119(b)). Upon reaching **D**, the pilot would descend to *8,000 feet* (even though the MEA was 7,000 feet), as 8,000 was the highest of the altitude situations stated in the rule (FAR—91.127).

(c) Leave holding fix/clearance limit.

1. If an EFC time has been received, leave the clearance limit/holding fix at that time and proceed to and

hold, if necessary, at the holding pattern depicted for the IAP or, if none is depicted, at the fix from which the approach begins. Any additional delay information the pilot has received should not be used or considered in the application of two-way communications failure procedures.

2. If an EFC time has not been received, the pilot is expected to proceed to and hold, if necessary, at the holding pattern depicted for the IAP or, if none is depicted, at the fix from which the approach begins. If more than one approach fix is available, it is pilot choice and ATC protects airspace at all of them.

NOTE.— The phrase *fix from which the approach begins* means any initial approach fix, or point at which the procedure track symbol begins, as depicted on the plan view of the instrument approach procedure.

(d) Descent for approach.

1. Begin descent from the en route altitude or flight level upon reaching the fix from which the approach begins, but not before the estimated time of arrival shown on the flight plan as amended with ATC.

2. If holding is necessary at the radio fix to be used for the approach at the destination airport, holding and descent to the initial approach altitude shall be accomplished in a holding pattern in accordance with the pattern depicted on the approach chart. If no holding pattern is depicted, holding and descent will be accomplished in a holding pattern on the side of the final approach course on which the procedure turn is described.

471. TRANSPONDER OPERATION DURING TWO-WAY COMMUNICATIONS FAILURE

a. If a pilot of an aircraft with a coded radar beacon transponder experiences a loss of two-way radio capability he should:

(1) Adjust his transponder to reply on MODE A/3, Code 7700 for a period of 1 minute.

(2) Then change to Code 7600 and remain on 7600 for a period of 15 minutes or the remainder of the flight, whichever comes first.

(3) Repeat steps (1) and (2) as practicable.

b. The pilot should understand that he may not be in an area of radar coverage.

472. REESTABLISHING RADIO CONTACT

a. In addition to monitoring the NAVAID voice feature, the pilot should attempt to reestablish communications by attempting contact:

(1) on the previously assigned frequency, or

(2) with an FSS or *ARINC.

b. If communcations are established with an FSS or ARINC, the pilot should advise that radio communications on the previously assigned frequency has been lost giving the aircraft's position, altitude, last assigned frequency and then request further clearance from the controlling facility. The preceding does not preclude the use of 121.5 MHz. There is no priority on which action should be attempted first. If the capability exists, do all at the same time.

NOTE.— *AERONAUTICAL RADIO/INCORPORATED (ARINC) - is a commercial communications corporation which designs, constructs, operates, leases or otherwise engages in radio activities serving the aviation community. ARINC has the capability of relaying information to/from ATC facilities throughout the country.

473—499. RESERVED

Chapter 6. SAFETY OF FLIGHT

Section 1. METEOROLOGY

500. NATIONAL WEATHER SERVICE AVIATION PRODUCTS

a. Weather service to aviation is a joint effort of the National Weather Service (NWS), the Federal Aviation Administration (FAA), the military weather services, and other aviation oriented groups and individuals. The NWS maintains an extensive surface, upper air and radar weather observing program; a nationwide aviation weather forecasting service; and also provides pilot briefing service. The majority of pilot weather briefings are provided by FAA personnel at Flight Service Stations (FSSs). Surface weather observations are taken by the NWS and NWS certified FAA, contract and supplemental observers and by automated observing systems. (See paragraph 509)

b. Aviation forecasts are prepared by 52 Weather Service Forecast Offices (WSFOs). These offices prepare and distribute approximately 500 terminal forecasts 3 times daily for specific airports in 50 states and the Caribbean (4 times daily in Alaska and Hawaii). These forecasts, which are amended as required, are valid for 24 hours. The last 6 hours are given in categorical outlook terms as described in PARA—505. WSFOs also prepare a total of over 300 route forecasts and 39 synopses for Pilots Automatic Telephone Weather Answering Service (PATWAS), Transcribed Weather Broadcast (TWEB), and briefing purposes. The route forecasts that are issued during the morning and mid-day are valid for 12 hours while the evening issuance is valid for 18 hours. A new centralized aviation forecast program originating from the National Aviation Weather Advisory Unit (NAWAU) in Kansas City was implemented in November 1982. In the conterminous U.S., all In-flight Advisories (SIGMETs, convective SIGMETs, and AIRMETs) and all Area Forecasts (6 areas) are now issued by NAWAU. The Area Forecasts are prepared 3 times a day in the conterminous states (4 times in Hawaii), and amended as required, while In-flight Advisories are issued only when conditions warrant. (See PARA—504.) Winds aloft forecasts are provided for 176 locations in the 48 contiguous states and 21 in Alaska for flight planning purposes. (Winds aloft forecasts for Hawaii are prepared locally). All of the aviation weather forecasts are given wide distribution through the Weather Message Switching Center in Kansas City (WMSC).

501. FAA WEATHER SERVICES

a. The FAA maintains a nationwide network of Flight Service Stations (FSSs) to serve the weather needs of pilots. In addition, NWS meteorologists are assigned to most Air Route Traffic Control Centers (ARTCCs) as part of the Center Weather Service Unit (CWSU). They provide advisory service and short-term forecasts (nowcasts) to support the needs of the FAA and other users of the system.

b. The primary source of preflight weather briefings is an individual briefing obtained from a briefer at the FSS or NWS. These briefings, which are tailored to your specific flight, are available 24 hours a day through the local FSS or through the use of toll free lines (INWATS). Numbers for these services can be found in the Airport/ Facility Directory under the FAA and NWS Weather and Aeronautical Information Telephone Numbers section and the DOT, Federal Aviation Administration or Department of Commerce, National Weather Service listing under U.S. Government in your local telephone directory. See paragraph-502 for the types of preflight briefings available and the type of information contained in each. NWS pilot briefers do not provide aeronautical information (NOTAMs, flow control advisories, etc.) nor do they accept flight plans.

c. Other sources of weather information are as follows:

(1) The A.M. Weather telecast on the PBS television network is a jointly sponsored 15-minute weather program designed for pilots. It is broadcast Monday through Friday mornings. Check TV listings in your area for station and exact times.

(2) The Transcribed Weather Broadcast (TWEB), telephone access to the TWEB (TEL-TWEB) and Pilots Automatic Telephone Weather Answering Service (PATWAS) provide continuously updated recorded weather information for short or local flights. Separate paragraphs in this section give additional information regarding these services.

(3) The Interim Voice Response System (IVRS) is now available in 24 metropolitan areas. Using this system, a limited weather data base can be accessed through the use of a TOUCH-TONE® telephone. The IVRS provides weather information for the conterminous United States 24 hours a day. Six weather products are provided: Severe Weather Forecast Alerts (AWW), Convective Sigmets (WST), Surface Observations (SA), Terminal Forecasts (FT), Winds Aloft Forecasts (GF), and TWEB Route Forecasts (TR). Pilots should be aware that among the products not provided are non-convective SIGMETS, AIRMETS, and Center Weather Advisories (CWA). These issuances must be obtained from the FSS or other available sources to supplement the IVRS information for flight planning purposes. A 24 hour toll-free number (800-367-4877) is available to answer pilot questions, to explain system operation and to respond to any system problems. Detailed instructions on how to use IVRS are contained in *"A Pilot's Guide to IVRS"*. A copy can be obtained from any FAA Flight Standards District Office or Flight Service Station. Comments, questions and requests for additional information may be directed to: IVRS Project Office, Federal Aviation Administration, APM-230, Washington, D.C. 20591. Telephone numbers for IVRS facilities in individual metropolitan areas are listed in the Airport/Facility Directories under the FAA and NWS weather and Aeronautical Information Telephone Numbers section.

(4) Weather and aeronautical information is also available from numerous private industry sources on an individual or contract pay basis. Information on how to obtain this service should be available from local pilot organizations.

d. In-flight weather information is available from any FSS within radio range. See PARA-506 through PARA—508 for information on broadcasts. En route Flight Advisory Service (EFAS) is provided to serve the nonroutine weather needs of pilots in flight. See PARA—503 for details on this service.

502. PREFLIGHT BRIEFING

a. Flight Service Stations (FSSs) are the primary source for obtaining preflight briefings and in-flight weather information. In some locations, the Weather Service Office (WSO) provides preflight briefings on a limited basis. Flight Service Specialists are qualified and certificated by the NWS as Pilot Weather Briefers. They are not authorized to make original forecasts, but are authorized to translate and interpret available forecasts and reports directly into terms describing the weather conditions which you can expect along your flight route and at your destination. Available aviation weather reports and forecasts are displayed at each FSS and WSO. Some of the larger FSSs provide a separate display for pilot use. Pilots should feel free to use these self briefing displays where available, or to ask for a briefing or assistance from the specialist on duty. Three basic types of preflight briefings are available to serve your specific needs. These are: Standard Briefing, Abbreviated Briefing, and Outlook Briefing. You should specify to the briefer the type of briefing you want, along with appropriate background information. (Refer to PARA—290 for items that are required.) This will enable the briefer to tailor the information to your intended flight. The following paragraphs describe the types of briefings available and the information provided in each.

b. STANDARD BRIEFING—You should request a Standard Briefing any time you are planning a flight and you have not received a previous briefing or have not received preliminary information through mass dissemination media; e.g., TWEB, PATWAS, VRS, etc. The briefer will automatically provide the following information in the sequence listed, except as noted, when it is applicable to your proposed flight.

(1) Adverse Conditions—Significant meteorological and aeronautical information that might influence the pilot to alter the proposed flight, e.g., hazardous weather conditions, runway closures, NAVAID outages, etc.

(2) VFR Flight Not Recommended—When VFR flight is proposed and sky conditions or visibilities are present or forecast, surface or aloft, that in the briefer's judgement would make flight under visual flight rules doubtful, the briefer will describe the conditions, affected locations, and use the phrase *"VFR flight is not recommended."* This recommendation is advisory in nature. The final decision as to whether the flight can be conducted safely rests solely with the pilot.

(3) Synopsis—A brief statement describing the type, location and movement of weather systems and/or air masses which might affect the proposed flight.

NOTE— These first 3 elements of a briefing may be combined in any order when the briefer believes it will help to more clearly describe conditions.

(4) Current Conditions—Reported weather conditions applicable to the flight will be summarized from all available sources; e.g., SAs, PIREPs, RAREPs. This element will be omitted if the proposed time of departure is beyond two hours, unless the information is specifically requested by the pilot.

(5) En Route Forecast—Forecast en route conditions for the proposed route are summarized in logical order; i.e., departure-climbout, en route, and descent.

(6) Destination Forecast—The destination forecast for the planned ETA. Any significant changes within 1 hour before and after the planned arrival are included.

(7) Winds Aloft—Forecast winds aloft will be summarized for the proposed route. The briefer will interpolate wind directions and speeds between levels and stations as necessary to provide expected conditions at planned altitudes.

(8) Notices to Airmen (NOTAMs)—

(a) Available NOTAM(D) information pertinent to the proposed flight.

(b) NOTAM(L) information pertinent to the departure and/or local area, if available, and pertinent FDC NOTAMs within approximately 400 miles of the FSS providing the briefing.

NOTE 1— NOTAM information may be combined with current conditions when the briefer believes it is logical to do so.

NOTE 2— NOTAM(D) information and FDC NOTAMs which have been published in the Notices to Airmen (Class II) Publication are not included in pilot briefings unless a review of this publication is specifically requested by the pilot. For complete flight information you are urged to review Class II NOTAMs and the Airport/Facility Directory in addition to obtaining a briefing.

(9) ATC Delays—Any known ATC delays and flow control advisories which might affect the proposed flight.

(10) Pilots may obtain the following from FSS briefers upon request:

(a) Information on military training routes and MOA activity within 100 NM of facility conducting briefing.

NOTE— For flights beyond 100 miles, pilots are encouraged to request updated information from en route FSSs.

(b) A review of the Notices to Airmen Publication (Class II NOTAMs) for pertinent NOTAMs and Special Notices.

(c) Approximate density altitude data.

(d) Information regarding such items as air traffic services and rules, customs/immigration procedures, ADIZ rules, search and rescue, etc.

(e) Other assistance as required.

c. ABBREVIATED BRIEFING— Request an Abbreviated Briefing when you need information to supplement mass disseminated data, update a previous briefing, or when you need only one or two specific items. Provide the briefer with appropriate background information, the time you received the previous information, and/or the specific items needed. You should indicate the source of the information already received so that the briefer can limit the briefing to the information that you have not received, and/or appreciable changes in meteorological conditions since your previous briefing. To the extent possible, the briefer will provide the information in the sequence shown for a Standard Briefing. If you request only one or two specific items, the briefer will advise you if adverse conditions are present or forecast. Details on these conditions will be provided at your request.

d. **OUTLOOK BRIEFING—** You should request an Outlook Briefing whenever your proposed time of departure is six or more hours from the time of the briefing. The briefer will provide available forecast data applicable to the proposed flight. This type of briefing is provided for planning purposes only. You should obtain a Standard or Abbreviated Briefing prior to departure in order to obtain such items as current conditions, updated forecasts, winds aloft and NOTAMs.

e. **INFLIGHT BRIEFING—** You are encouraged to obtain your preflight briefing by telephone or in person before departure. In those cases where you need to obtain a preflight briefing or an update to a previous briefing by radio, you should contact the nearest FSS to obtain this information. After communications have been established, advise the specialist of the type briefing you require and provide appropriate background information. You will be provided information as specified in the above paragraphs, depending on the type briefing requested. In addition, the specialist will recommend shifting to the flight watch frequency when conditions along the intended route indicate that it would be advantageous to do so.

f. Following any briefing, feel free to ask for any information that you or the briefer may have missed. It helps to save your questions until the briefing has been completed. This way, the briefer is able to present the information in a logical sequence, and lessens the chance of important items being overlooked.

503. EN ROUTE FLIGHT ADVISORY SERVICE (EFAS)

a. EFAS is a service specifically designed to provide en route aircraft with timely and meaningful weather advisories pertinent to the type of flight intended, route of flight and altitude. In conjunction with this service, EFAS is also a central collection and distribution point for pilot reported weather information. It is normally available throughout the conterminous U.S. and Puerto Rico from 6 a.m. to 10 p.m. EFAS provides communications capabilities for aircraft flying at 5,000 feet above ground level on a common frequency of 122.0 MHz. High altitude EFAS, now in the process of being implemented in some areas of the country, provides a separate discrete frequency within each Air Route Traffic Control Center's area for use only by aircraft flying at an altitude of 18,000 feet MSL and above. EFAS is provided by specially trained specialists in selected FSSs controlling one or more remote communications outlets covering a large geographical area.

b. Contact flight watch by using the name of the parent facility, followed by your aircraft identification and append the name of the nearest VOR to your position. The specialist needs to know this approximate location to select the most appropriate outlet for communications coverage.

EXAMPLE:

CLEVELAND FLIGHT WATCH, CESSNA ONE TWO THREE FOUR KILO, MANSFIELD VOR OVER.

c. Charts depicting the location of the flight watch control stations (parent facility) and the outlets they use are contained in the Airport Facility Directories (A/FD). If you do not know in which flight watch area you are flying, initiate contact by using the words "FLIGHT WATCH," your aircraft identification, and the name of the nearest VOR. The facility will respond using the name of the flight watch facility.

EXAMPLE:

FLIGHT WATCH, CESSNA ONE TWO THREE FOUR KILO, MANSFIELD VOR OVER.

d. En route Flight Advisory Service is provided by the following FSSs:

Albuquerque, NM
Birmingham, AL
Buffalo, NY
Charleston, WV
Cleveland, OH
Conroe, TX
Fort Worth, TX
Hawthorne, CA
Indianapolis, IN
Memphis, TN
Minneapolis, MN
Oakland, CA
Pittsburgh, PA
Prescott, AZ
Salt Lake City, UT
Seattle, WA
Walla Walla, WA

Atlanta, GA
Bridgeport, CT
Charleston, SC
Chicago, IL
Columbia, MO
Denver, CO
Grand Forks, ND
Huron, SD
Jackson, MS
Miami, FL
Montpelier, VT
Omaha, NE
Portland, OR
Raleigh, NC
San Juan, PR
Teterboro, NJ
Washington, DC

e. EFAS is not intended to be used for filing or closing flight plans, position reporting, to get a complete preflight briefing, or to obtain random weather reports and forecasts. In such instances, the flight watch specialist will provide the name and radio frequency of the FSS to contact for such services. Pilot participation is essential to the success of EFAS through a continuous exchange of information on winds, turbulence, visibility, icing, etc., between pilots in-flight and flight watch specialists on the ground. Pilots are encouraged to report good as well as bad and expected as well as unexpected flight conditions to flight watch facilities.

504. IN-FLIGHT WEATHER ADVISORIES

a. The NWS issues in-flight weather advisories designated as convective SIGMETs (WST), SIGMETs (WS), Center Weather Advisory (CWA), or AIRMETs (WA). These advisories are issued individually, however, the information contained in them is also included in relevant portions of the Area Forecast (FA). When these advisories are issued subsequent to the FA, they automatically amend appropriate portions of the FA until the FA itself has been amended. In-flight advisories serve to notify en route pilots of the possibility of encountering hazardous flying conditions which may not have been forecast at the time of the preflight briefing. Whether or not the condition described is potentially hazardous to a particular flight is for the pilot to evaluate on the basis of experience and the operational limits of the aircraft.

b. Convective SIGMETs are issued for the following phenomena:

(1) Tornadoes.

(2) Lines of thunderstorms.

(3) Embedded thunderstorms.

(4) Thunderstorm areas greater than or equal to thunderstorm intensity level 4 with an area coverage of 4/10 (40 percent) or more. (See RADAR WEATHER ECHO INTENSITY LEVELS in Pilot/Controller Glossary.)

(5) Hail greater than or equal to 3/4 inch diameter.

NOTE.— Since thunderstorms are the reason for issuing the convective SIGMET, severe or greater turbulence, severe icing, and low-level wind shear (gust fronts, etc) are implied and will not be specified in the advisory.

c. CONVECTIVE SIGMET BULLETINS:

(1) Three Convective SIGMET bulletins, each covering a specified geographic area, are issued. These areas are the Eastern (E), Central (C), and Western (W) U.S. These bulletins are issued on a scheduled basis, hourly at 55 minutes past the hour (H+55), and as special bulletins on an unscheduled basis. The boundaries that separate the Eastern and Central, and the Central and Western U.S. are 87 and 107 degrees West, respectively. (See following figure for VORs and major locations used as reference points for the In-Flight Weather Advisory messages.)

(2) Each of the Convective SIGMET bulletins will be:

(a) Made up of one or more individually numbered Convective SIGMETs,

(b) Valid for 1 hour, and

(c) Removed from system automatically at 40 minutes past the hour (H+40).

d. SIGMETs within the conterminous U.S. are issued by the National Aviation Weather Advisory Unit (NAWAU) for the following hazardous weather phenomena:

(1) Severe and extreme turbulence.

(2) Severe icing.

(3) Widespread duststorms, sandstorms, or volcanic ash lowering visibilities to below three miles.

e. Center Weather Advisory: The CWA is an unscheduled in-flight, flow control, air traffic, and air crew advisory. By nature of its short lead time, the CWA is not a flight planning product. It is generally a Nowcast for conditions beginning within the next 2 hours. CWAs will be issued:

(1) As a supplement to an existing SIGMET, Convective SIGMET, AIRMET, or Area Forecast (FA).

(2) When an In-flight Advisory has not been issued but observed or expected weather conditions meet SIGMET/AIRMET criteria based on current pilot reports and reinforced by other sources of information about existing meteorological conditions.

(3) When observed or developing weather conditions do not meet SIGMET, Convective SIGMET, or AIRMET criteria, e.g., in terms of intensity or area coverage, but current pilot reports or other weather information sources indicate that an existing or anticipated meteorological phenomena will adversely affect the safe flow of air traffic within the air route traffic control center (ARTCC) area of responsibility.

f. AIRMETs within the conterminous U.S. are issued by the NAWAU for the following weather phenomena which are potentially hazardous to aircraft:

(1) Moderate icing.

(2) Moderate turbulence.

(3) Sustained winds of 30 knots or more at the surface.

(4) Widespread area of ceilings less than 1,000 feet and/or visibility less than three miles.

(5) Extensive mountain obscurement.

NOTE— If the above phenomena are adequately forecast in the FA, an AIRMET will not be issued.

g. SIGMETs and AIRMETs are identified by an alphanumeric designator which consists of an alphabetic identifier and issuance number. The first time an advisory is issued for a phenomenon associated with a particular weather system, it will be given the next alphabetic designator in the series, and will be numbered as the first for that designator, e.g., BRAVO 1. Subsequent advisories will retain the same alphabetic designator until the phenomenon ends. In the conterminous U.S., this means that a phenonmenon that is assigned an alphabetic designator in one area will retain that designator as it moves within the area or into one or more other areas. Issuances for the same phenomenon will be sequentially numbered, using the same alphabetic designator until the phenomena no longer exist. Alphabetic designators ALFA—NOVEMBER are used only for SIGMETs, while designators OSCAR—ZULU are used for AIRMETs.

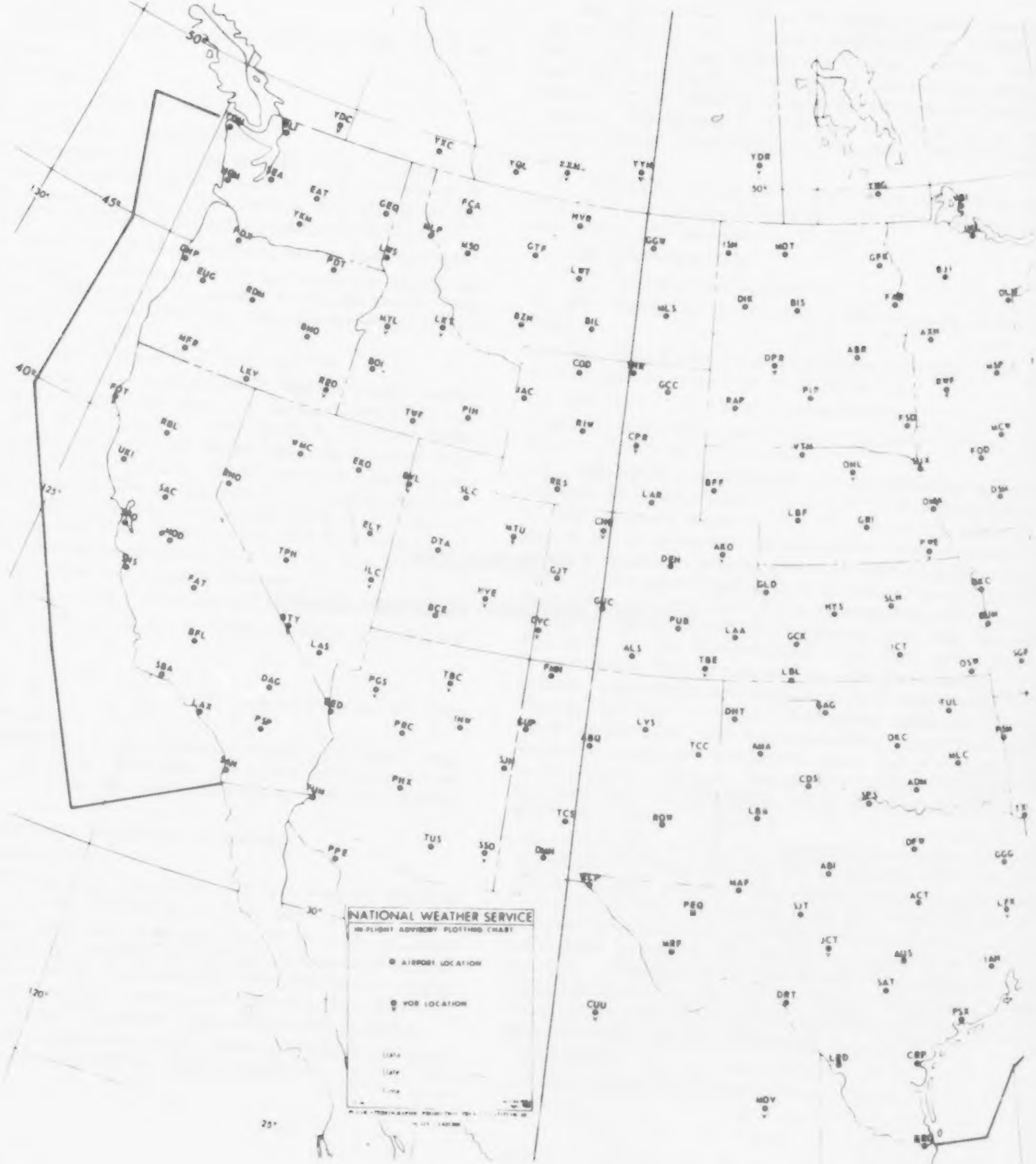
h. Each CWA will have a phenomenon number (1-6) immediately following the ARTCC identifier. This number will be assigned to each meteorologically distinct condition or conditions (e.g., jet stream clear air turbulence or low IFR and icing northwest of a low pressure center) meeting CWA issuance criteria. Following the product type (CWA) a two digit issuance number will be entered starting at midnight local each day. In addition those CWAs based on existing nonconvective SIGMETs/AIRMETs will include the associated alphanumeric designator (e.g. ALPHA 4).

EXAMPLE:

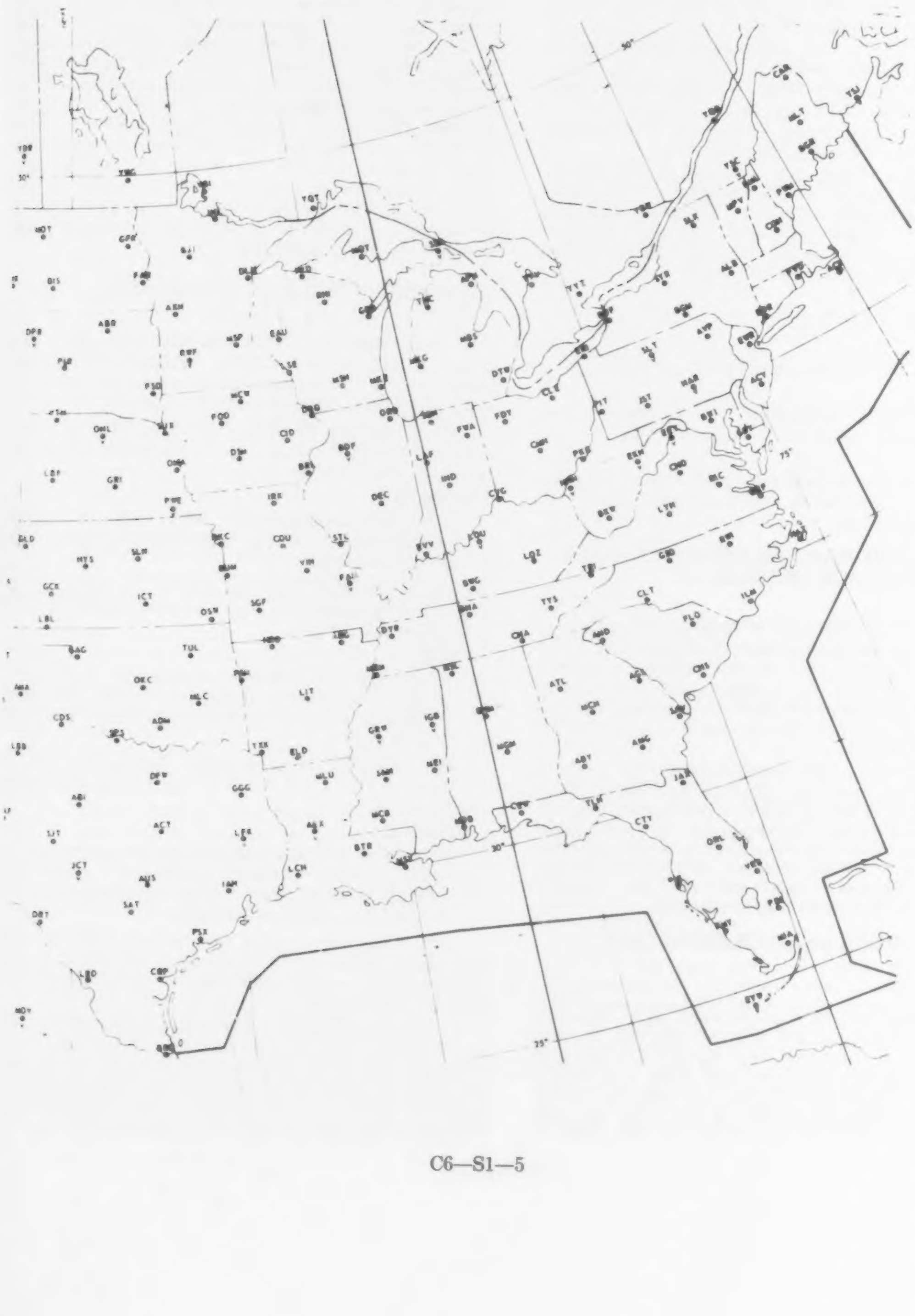
ZKC1 CWA01/ALPHA 4

METEOROLOGY

IN-FLIGHT ADVISORY PLOTTING CHART

NATIONAL WEATHER SERVICE
IN-FLIGHT ADVISORY PLOTTING CHART
AIRPORT LOCATION
VOR LOCATION
Date
Date
Time
50°
45°
40°
35°
30°
25°
130°
125°
120°
YDC
YXC
YQL
YYN
YDR
SEA
EAT
GEG
FCA
HVR
YKM
MSO
GTF
GGW
ISN
MOT
GFK
BJI
DLH
ONP
EUG
RDM
PDT
LWS
LWT
DIK
BIS
FAR
MLS
BNO
BZN
BIL
ABR
AXN
MFR
LKV
REO
BOI
COD
DPR
MSP
FOT
JAC
GCC
RAP
PIR
TWF
PIH
RIW
FSD
RBL
WMC
EKO
CPR
ONL
SUX
FOD
UKI
RNO
SLC
RKS
BFF
LAR
OMA
DSM
SAC
ELY
MTU
CYS
LBF
GRI
MOD
TPH
DTA
DEN
AKO
FAT
ILC
HVE
GJT
GLD
MKC
BCE
BTY
GUC
MTS
SLN
BFL
LAS
DVC
PUB
LAA
GCK
ICT
SBA
PGS
TBC
ALS
TBE
LBL
SGF
DAG
FMN
DHT
GAG
TUL
LAX
PSP
EED
PRC
INW
GUP
ABQ
LVS
TCC
AMA
OKC
MLC
FSM
SAN
SJN
PHX
CDS
SPS
ADM
YUM
TCS
ROW
LBB
PPE
TUS
SSO
DMN
ELP
DFW
GGG
ABI
MAF
PEQ
SJT
ACT
LFK
MRF
JCT
AUS
IAH
SAT
CUU
DRT
PSX
LRD
CRP
MOY
BRO

IN-FLIGHT ADVISORY PLOTTING CHART


50°
30°
25°
75°
MOT
BIS
ABR
FAR
DLH
MSP
EAU
RWF
FSD
MCW
FOD
OMA
DSM
CID
GRI
LBF
ICT
SLN
HYS
GCK
LBL
TUL
OKC
AMA
CDS
LBB
ABI
DFW
ACT
SJT
JCT
AUS
SAT
DRT
LRD
CRP
PSX
IAH
LCH
LFK
GGG
SPS
ADM
MLC
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ATL
MCN
ABY
AGS
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LYH
EKN
JST
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ACY
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ALB
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CLE
DTW
FWA
IND
LAF
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STL
COU
SGF
EVV
LOZ
BWG
CTY
ORL
VRB
MIA
YQT
CAR
TVC
MBS
MKG

505. CATEGORICAL OUTLOOKS

a. Categorical outlook terms, describing general ceiling and visibility conditions for advanced planning purposes, are defined as follows:

(1) LIFR (Low IFR) — Ceiling less than 500 feet and/or visibility less than 1 mile.

(2) IFR — Ceiling 500 to less than 1,000 feet and/or visibility 1 to less than 3 miles.

(3) MVFR (Marginal VFR) — Ceiling 1,000 to 3,000 feet and/or visibility 3 to 5 miles inclusive.

(4) VFR — Ceiling greater than 3,000 feet and visibility greater than 5 miles; includes sky clear.

b. The cause of LIFR, IFR, or MVFR is indicated by either ceiling or visibility restrictions or both. The contraction "CIG" and/or weather and obstruction to vision symbols are used. If winds or gusts of 25 knots or greater are forecast for the outlook period, the word "WIND" is also included for all categories, including VFR.

EXAMPLE:

LIFR CIG — Low IFR due to low ceiling.

EXAMPLE:

IFR F — IFR due to visibility restricted by fog.

EXAMPLE:

MVFR CIG H K — Marginal VFR due both to ceiling and to visibility restricted by haze and smoke.

EXAMPLE:

IFR CIG R WIND — IFR due both to low ceiling and to visibility restricted by rain: wind expected to be 25 knots or greater.

506. PILOTS AUTOMATIC TELEPHONE WEATHER ANSWERING SERVICE (PATWAS)

a. PATWAS is a continuous recording of meteorological and aeronautical information which is available at selected locations by telephone. Normally the recording contains a summary of data for an area within 50NM of the parent station; however, at some locations route information similar to that available on the Transcribed Weather Broadcast (TWEB) is included.

b. PATWAS is not intended to substitute for specialist provided preflight briefings except for local flights. It is, however, recommended for use as a preliminary briefing, and often will be valuable in helping you to make a "go or no go" decision. Pilots are encouraged to avail themselves of this service. PATWAS locations are found in the Airport/Facility Directory under the FSS and National Weather Service Telephone Numbers section.

507. TRANSCRIBED WEATHER BROADCAST (TWEB)

a. Equipment is provided at selected FSSs by which meteorological and aeronautical data are recorded on tapes and broadcast continuously over selected low-frequency (190-535 kHz) navigational aids (L/MF range or H facility) and/or VORs. Broadcasts are made from a series of individual tape recordings, and changes, as they occur, are transcribed onto the tapes. The information provided varies depending on the type equipment available. Generally the broadcast contains route oriented data with specially prepared NWS forecasts, In-flight Advisories and winds aloft, plus preselected current information such as weather reports, NOTAMs and special notices. In some locations, the information is broadcast over the local VOR only and is limited to such items as the hourly weather for the parent station and up to 5 immediately adjacent stations, local NOTAM information, terminal forecast (FT) for the parent station, adverse conditions extracted from In-flight Advisories and other potentially hazardous conditions. At selected locations telephone access to the TWEB has been provided (TEL-TWEB). Telephone numbers for this service are found in the FSS and National Weather Service Telephone Numbers section of the Airport/Facility Directory. These broadcasts are made available primarily for preflight and in-flight planning, and as such, should not be considered as a substitute for specialist provided preflight briefings except for local flights.

508. IN-FLIGHT WEATHER BROADCASTS

a. WEATHER ADVISORY BROADCASTS - FAA FSSs broadcast Convective SIGMETs, SIGMETs, CWAs, and AIRMETs during their valid period when they pertain to the area within 150 NM of the FSS as follows:

(1) Convective SIGMET - Upon receipt and at 15-minute intervals H+00, H+15, H+30, and H+45 for the first hour after issuance.

EXAMPLE:

AVIATION BROADCAST, WEATHER ADVISORY, CONVECTIVE SIGMET (IDENTIFICATION) (TEXT OF ADVISORY).

(2) SIGMETs, CWAs, and AIRMETs - Upon receipt and at 30-minute intervals at H+15 and H+45 for the first hour after issuance.

EXAMPLE:

AVIATION BROADCAST, WEATHER ADVISORY, (AREA OR ARTCC IDENTIFICATION) SIGMET, CWA, OR AIRMET (IDENTIFICATION) (TEXT OF ADVISORY).

(3) Thereafter, a summarized alert notice will be broadcast at H+15 and H+45 during the valid period of the advisories.

EXAMPLE:

AVIATION BROADCAST, WEATHER ADVISORY, A (CONVECTIVE SIGMET) (SIGMET) (CWA) OR (AIRMET) IS CURRENT FOR (DESCRIPTION OF WEATHER) (AREA AFFECTED).

(4) Pilots, upon hearing the alert notice, if they have not received the advisory or are in doubt, should contact the nearest FSS and ascertain whether the advisory is pertinent to their flights.

b. ARTCCs broadcast a Convective SIGMET, SIGMET, or CWA alert once on all frequencies, except emergency, when any part of the area described is within 150 miles of the airspace under their jurisdication. These broadcasts contain SIGMET or CWA (Identification) and a brief description of the weather activity and general area affected.

EXAMPLE:

ATTENTION ALL AIRCRAFT, SIGMET DELTA THREE, FROM MYTON TO TUBA CITY TO MILFORD, SEVERE TURBULENCE, AND SEVERE CLEAR ICING BELOW ONE ZERO THOUSAND FEET. EXPECTED TO CONTINUE BEYOND ZERO THREE ZERO ZERO ZULU.

EXAMPLE:

ATTENTION ALL AIRCRAFT, CONVECTIVE SIGMET TWO SEVEN EASTERN. FROM THE VICINITY OF ELMIRA TO PHILLIPSBURG. SCATTERED EMBEDDED THUNDERSTORMS MOVING EAST AT ONE ZERO KNOTS. A FEW INTENSE LEVEL FIVE CELLS, MAXIMUM TOPS FOUR FIVE ZERO.

EXAMPLE:

ATTENTION ALL AIRCRAFT, KANSAS CITY CENTER WEATHER ADVISORY ONE ZERO THREE. NUMEROUS REPORTS OF MODERATE TO SEVERE ICING FROM EIGHT TO NINER THOUSAND FEET IN A THREE ZERO MILE RADIUR OF ST. LOUIS. LIGHT OR NEGATIVE ICING REPORTED FROM FOUR THOUSAND TO ONE TWO THOUSAND FEET REMAINDER OF KANSAS CITY CENTER AREA.

NOTE.— Terminal control facilities have the option to limit the convective SIGMET, SIGMET, or CWA broadcast as follows: local control and approach control positions may opt to broadcast SIGMET or CWA alerts only when any part of the area described is within 50 miles of the airspace under their jurisdiction.

c. HAZARDOUS IN-FLIGHT WEATHER ADVISORY SERVICE (HIWAS) - This is a continuous broadcast of in flight weather advisories including summarized SIGMETs, convective SIGMETs, CWAs, AIRMETs and urgent PIREPs. HIWAS has been adopted as a national program and will be implemented throughout the conterminous U.S. as resources permit. In those areas where HIWAS is commissioned, ARTCC, Terminal ATC and FSS facilities have discontinued the broadcast of in-flight advisories as described in the preceding paragraph. HIWAS is an additional source of hazardous weather information which makes these data available on a continuous basis. It is not, however, a replacement for preflight or in-flight briefings or real-time weather updates from Flight Watch (EFAS). As HIWAS is implemented in individual center areas, the commissioning will be advertised in the Notices to Airmen (Class II) Publication.

(1) Where HIWAS Has Been Implemented - A HIWAS alert will be broadcast on all except emergency frequencies once upon receipt by ARTCC and terminal facilities which will include an alert announcement, frequency instruction, number, and type of advisory updated, e.g., SIGMET, Convective SIGMET, or CWA.

EXAMPLE:

ATTENTION ALL AIRCRAFT, MONITOR HIWAS OR CONTACT A FLIGHT SERVICE STATION ON FREQUENCY ONE TWO TWO POINT ZERO OR ONE TWO TWO POINT TWO FOR NEW CONVECTIVE SIGMET (IDENTIFICATION) INFORMATION.

(2) In HIWAS ARTCC Areas - FSSs will broadcast a HIWAS update announcement once on all except emergency frequencies upon completion of recording an update to the HIWAS broadcast. Included in the broadcast will be the type of advisory updated, e.g., SIGMET, convective SIGMET, CWA, ect.

EXAMPLE:

ATTENTION ALL AIRCRAFT, MONITOR HIWAS OR CONTACT FLIGHT WATCH OR FLIGHT SERVICE FOR NEW CONVECTIVE SIGMET INFORMATION.

d. UNSCHEDULED BROADCASTS - These broadcasts are made by FSSs on VOR and selected VHF frequencies upon receipt of special weather reports, PIREPs, NOTAMs and other information considered necessary to enhance safety and efficiency of flight. These broadcasts will be made at random times and will begin with the announcement "Aviation Broadcast" followed by identification of the data.

EXAMPLE:

AVIATION BROADCAST, SPECIAL WEATHER REPORT, (Notice to Airmen, Pilot Report, etc.) (location name twice) THREE SEVEN (past the hour) OBSERVATION...etc.

e.ALASKAN SCHEDULED BROADCASTS - Selected FSSs in Alaska having voice capability on radio ranges (VOR) or radio beacons (NDB) broadcast weather reports and Notice to Airmen information at 15 minutes past each hour from reporting points within approximately 150 miles from the broadcast station.

509. WEATHER OBSERVING PROGRAMS

a. Manual Observations - Surface weather observations are taken at more than 600 locations in the United States. With only a few exceptions, these stations are located at airport sites and most are manned by FAA or NWS personnel who manually observe, perform calculations, and enter the observation into the distribution system. The format and coding of these observations are contained in paragraph 527.

b. Automated Weather Observing System (AWOS)

(1) Automated weather reporting systems are now being installed at several airports. These systems consist of various sensors, a processor, a voice synthesizer, and transmitter to relay local real-time weather data directly to the pilot.

(2) Generically referred to as AWOS (Automated Weather Observing System), these real-time systems are operationally classified into three basic levels: AWOS-1, AWOS-2, and AWOS-3. AWOS-1 reports altimeter setting and wind data, and usually temperature, dewpoint, and density altitude. AWOS-2, when approved for operational use, will provide the information provided by AWOS-1, plus visibility. AWOS-3, when approved for operational use, will provide the information provided by AWOS-1, plus visibility and cloud/ceiling data.

(3) The information is transmitted over a radio frequency or the voice portion of a local NAVAID. AWOS transmissions are receivable within 25 NM of the AWOS site, at or above 3000 feet AGL. In many cases, AWOS signals are receivable on the surface of the airport. Most devices automatically transmit a 20 to 30 second weather message once each minute. Pilots should monitor the designated frequency for the automated weather message. There is no two-way communication capability. Most AWOS weather data can be accessed via telephone.

(4) Selected individual systems may be incorporated into nationwide data collection and dissemination networks in the future. AWOS information (system level, frequency, phone number, etc.) concerning specific locations, will be published as they become operational, in the Airport/Facility Directory, and where applicable, on published Instrument Approach Procedures.

c. Automatic Meteorological Observing Stations (AMOS)

(1) Full parameter AMOS facilities probide data for the basic weather program at remote, unstaffed, or part-time staffed locations at approximately ninety locations in the United States. They report temperature, dew point, wind, pressure, and precipitation (liquid) amount. At staffed AMOS locations, an observer may manually add visually observed and manually calculated elements to the automatic reports. The elements manually added are sky condition, visibility, weather, obstructions to vision, and sea level pressure. The content and format of AMOS reports is the same as the manually observed reports, except the acronym "AMOS" or "RAMOS" (for Remote Automatic Meteorological Observing Station) will be the first item of the report.

(2) Partial parameter AMOS stations only report some of the elements contained in the full parameter locations, normally wind. These observations are not normally disseminated through aviation weather circuits.

d. Automatic Observing Stations (AUTOB) - There are four AUTOBs in operation located at Winslow, Arizona (INW); Sandberg, California (SDB); Del Rio, Texas (DRT); and Wendover, Utah (ENV). These stations report all normal surface aviation weather elements, but cloud height and visibility are reported in a manner different from the conventional weather report. See paragraph 528 for a description of these reports.

510. WEATHER RADAR SERVICES

a. The National Weather Service operates a network of 56 radar sites for detecting coverage, intensity, and movement of precipitation. The network is supplemented by FAA and DOD radar sites in the western sections of the country. Another 72 local warning radars augment the network by operating on an as needed basis to support warning and forecast programs.(See map.)

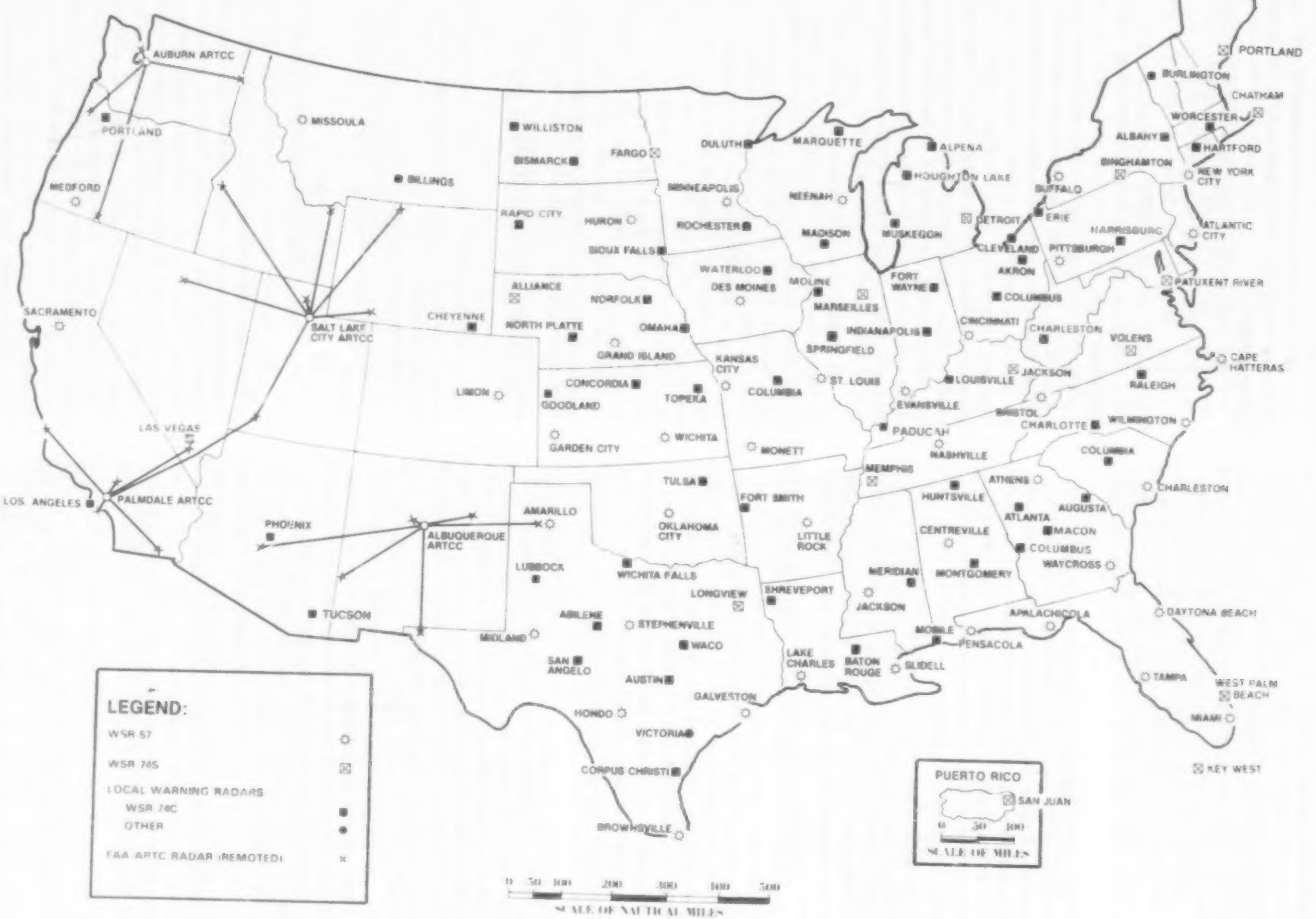
b. Scheduled radar observations are taken hourly and transmitted in alpha-numeric format on weather telecommunications circuits for flight planning purposes. Under certain conditions special radar reports are issued in addition to the hourly transmittals. Data contained in the reports is also collected by the National Meteorological Center and used to prepare hourly national radar summary charts for dissemination on facsimile circuits.

c. All En Route Flight Advisory Service facilities and many Flight Service Stations have equipment to directly access the radar displays from the individual weather radar sites. Specialists at these locations are trained to interpret the display for pilot briefing and in-fight advisory services. The Center Weather Service Units located in the Air Route Traffic Control Centers also have access to weather radar displays and provide support to all air traffic facilities within their center's area.

d. A clear radar display (no echoes) does not mean that there is no significant weather within the converage of the radar site. Clouds and fog are not detected by the radar, however, when echoes are present, turbulence can be implied by the intensity of the precipitation and icing is implied by the presence of the precipitation at temperatures at or below zero degrees Celsius. Used in conjunction with other weather products, the radar provides invaluable information for seather avoidance and flight planning.

e. Additional information on weather radar products and services can be found in Advisory Circular 00-45, AVIATION WEATHER SERVICES. Also, see Glossary, Radar Weather Echo Intensity Levels and paragraph 526, Thunderstorms.

NOAA NATIONAL WEATHER SERVICE RADAR NETWORK


AUBURN ARTCC
PORTLAND
MEDFORD
SACRAMENTO
LAS VEGAS
LOS ANGELES
PALMDALE ARTCC
MISSOULA
BILLINGS
SALT LAKE CITY ARTCC
CHEYENNE
LIMON
PHOENIX
TUCSON
ALBUQUERQUE ARTCC
WILLISTON
BISMARCK
FARGO
RAPID CITY
HURON
SIOUX FALLS
ALLIANCE
NORFOLK
NORTH PLATTE
OMAHA
GRAND ISLAND
CONCORDIA
GOODLAND
TOPEKA
GARDEN CITY
WICHITA
AMARILLO
LUBBOCK
MIDLAND
ABILENE
SAN ANGELO
WICHITA FALLS
STEPHENVILLE
WACO
AUSTIN
HONDO
VICTORIA
CORPUS CHRISTI
BROWNSVILLE
GALVESTON
TULSA
OKLAHOMA CITY
LONGVIEW
SHREVEPORT
FORT SMITH
LITTLE ROCK
DULUTH
MINNEAPOLIS
ROCHESTER
WATERLOO
DES MOINES
KANSAS CITY
COLUMBIA
MONETT
MARQUETTE
NEENAH
MADISON
MOLINE
MARSEILLES
SPRINGFIELD
ST. LOUIS
INDIANAPOLIS
ALPENA
HOUGHTON LAKE
MUSKEGON
DETROIT
FORT WAYNE
EVANSVILLE
LOUISVILLE
CINCINNATI
PADUCAH
MEMPHIS
NASHVILLE
LAKE CHARLES
BATON ROUGE
SLIDELL
JACKSON
MERIDIAN
MOBILE
PENSACOLA
HUNTSVILLE
CENTREVILLE
MONTGOMERY
ATHENS
ATLANTA
MACON
COLUMBUS
AUGUSTA
WAYCROSS
APALACHICOLA
TAMPA
DAYTONA BEACH
WEST PALM BEACH
MIAMI
KEY WEST
CLEVELAND
AKRON
COLUMBUS
ERIE
BUFFALO
PITTSBURGH
CHARLESTON
JACKSON
BRISTOL
CHARLOTTE
COLUMBIA
CHARLESTON
WILMINGTON
RALEIGH
VOLENS
CAPE HATTERAS
PATUXENT RIVER
ATLANTIC CITY
HARRISBURG
BINGHAMTON
NEW YORK CITY
ALBANY
HARTFORD
WORCESTER
CHATHAM
BURLINGTON
PORTLAND
PUERTO RICO
SAN JUAN
0 50 100
SCALE OF MILES
0 50 100 200 300 400 500
SCALE OF NAUTICAL MILES
LEGEND:
WSR 57 ☼
WSR 74S ☒
LOCAL WARNING RADARS
WSR 74C ■
OTHER ●
FAA ARTC RADAR (REMOTED) ×

511. ATC IN-FLIGHT WEATHER AVOIDANCE ASSISTANCE

a. ATC Radar Weather Display

(1) Areas of radar weather clutter result from rain or moisture. Radars cannot detect turbulence. The determination of the intensity of the weather displayed is based on its precipitation density. Generally, the turbulence associated with a very heavy rate of rainfall will normally be more severe than any associated with a very light rainfall rate.

(2) ARTCCs are phasing in computer generated digitized radar displays to replace broadband radar display. This new system, known as Narrowband Radar, provides the controller with two distinct levels of weather intensity by assigning radar display symbols for specific precipitation densities measured by the narrowband system.

b. Weather Avoidance Assistance

(1) To the extent possible, controllers will issue pertinent information on weather or chaff areas and assist pilots in avoiding such areas when requested. Pilots should respond to a weather advisory by either acknowledging the advisory or by acknowledging the advisory and requesting an alternative course of action as follows:

(a) Request to deviate off course by stating the number of miles and the direction of the requested deviation. In this case, when the requested deviation is approved, the pilot is expected to provide his own navigation, maintain the altitude assigned by ATC and to remain within the specified mileage of his original course.

(b) Request a new route to avoid the affected area.

(c) Request a change of altitude.

(d) Request radar vectors around the affected areas.

(2) For obvious reasons of safety, an IFR pilot must not deviate from the course or altitude or flight level without a proper ATC clearance. When weather conditions encountered are so severe that an immediate deviation is determined to be necessary and time will not permit approval by ATC, the pilot's emergency authority may be exercised.

(3) When the pilot requests clearance for a route deviation or for an ATC radar vector, the controller must evaluate the air traffic picture in the affected area, and coordinate with other controllers (if ATC jurisdictional boundaries may be crossed) before replying to the request.

(4) It should be remembered that the controller's primary function is to provide safe separation between aircraft. Any additional service, such as weather avoidance assistance, can only be provided to the extent that it does not derogate the primary function. It's also worth noting that the separation workload is generally greater than normal when weather disrupts the usual flow of traffic. ATC radar limitations and frequency congestion may also be a factor in limiting the controller's capability to provide additional service.

(5) It is very important, therefore, that the request for deviation or radar vector be forwarded to ATC as far in advance as possible. Delay in submitting it may delay or even preclude ATC approval or require that additional restrictions be placed on the clearance. Insofar as possible the following information should be furnished to ATC when requesting clearance to detour around weather activity:

(a) Proposed point where detour will commence.

(b) Proposed route and extent of detour (direction and distance).

(c) Point where original route will be resumed.

(d) Flight conditions (IFR or VFR).

(e) Any further deviation that may become necessary as the flight progresses.

(f) Advise if the aircraft is equipped with functioning airborne radar.

(6) To a large degree, the assistance that might be rendered by ATC will depend upon the weather information available to controllers. Due to the extremely transitory nature of severe weather situations, the controller's weather information may be of only limited value if based on weather observed on radar only. Frequent updates by pilots giving specific information as to the area affected, altitudes intensity and nature of the severe weather can be of considerable value. Such reports are relayed by radio or phone to other pilots and controllers and also receive widespread teletypewriter dissemination.

(7) Obtaining IFR clearance or an ATC radar vector to circumnavigate severe weather can often be accommodated more readily in the en route areas away from terminals because there is usually less congestion and, therefore, offer greater freedom of action. In terminal areas, the problem is more acute because of traffic density, ATC coordination requirements, complex departure and arrival routes, adjacent airports, etc. As a consequence, controllers are less likely to be able to accommodate all requests for weather detours in a terminal area or be in a position to volunteer such routing to the pilot. Nevertheless, pilots should not hesitate to advise controllers of any observed severe weather and should specifically advise controllers if they desire circumnavigation of observed weather.

512. RUNWAY VISUAL RANGE (RVR)

a. RVR visibility values are measured by transmissometers mounted on towers along the runway. A full RVR system consists of:

(1) Transmissometer projector and related items.

(2) Transmissometer receiver (detector) and related items.

(3) Analogue recorder.

(4) Signal data converter and related items.

(5) Remote digital or remote display programmer.

b. The transmissometer projector and receiver are mounted on towers either 250 or 500 feet apart. A known intensity of light is emitted from the projector and is measured by the receiver. Any obscuring matter such as rain, snow, dust, fog, haze or smoke reduces the light intensity arriving at the receiver. The resultant intensity measurement is then converted to an RVR value by the signal data converter. These values are displayed by readout equipment in the associated air traffic facility and updated approximately once every minute for controller issuance to pilots.

c. The signal data converter receives information on the high intensity runway edge light setting in use (step 3,

4, or 5); transmission values from the transmissometer, and the sensing of day or night conditions. From the three data sources, the system will compute appropriate RVR values. Due to variable conditions, the reported RVR values may deviate somewhat from the true observed visual range due to the slant range consideration, brief time delays between the observed RVR conditions and the time they are transmitted to the pilot, and rapidly changing visibility conditions.

d. An RVR transmissometer established on a 500 foot baseline provides digital readouts to a minimum of 1,000 feet. A system established on a 250 foot baseline provides digital readouts to a minimum of 600 feet, which are displayed in 200 foot increments to 3000 feet and in 500 foot increments from 3,000 feet to a maximum value of 6,000 feet.

e. RVR values for Category IIIa operations extend down to 700 feet RVR; however, only 600 and 800 feet are reportable RVR increments. The 800 RVR reportable value covers a range of 701 feet to 900 feet and is therefore a valid minimum indication of Category IIIa operations.

f. Approach categories with the corresponding minimum RVR values are as follows:

Category	*Visibility (RVR)*
Nonprecision	2400 feet
Category I	1800 feet
Category II	1200 feet
Category IIIa	700 feet
Category IIIb	150 feet
Category IIIc	0 feet

g. Ten minute maximum and minimum RVR values for the designated RVR runway are reported in the remarks section of the aviation weather report when the prevailing visibility is less than one mile and/or the RVR is 6,000 feet or less. ATCTs report RVR when the prevailing visibility is 1 mile or less and/or the RVR is 6,000 feet or less.

h. Details on the requirements for the operational use of RVR are contained in FAA ADVISORY CIRCULAR—97-1, "RUNWAY VISUAL RANGE." Pilots are responsible for compliance with minimums prescribed for their class of operations in appropriate FARs and/or operations specifications.

513. REPORTING OF CLOUD HEIGHTS

a. Ceiling, by definition in FARs, and as used in Aviation Weather Reports and Forecasts, is the height *above ground (or water) level* of the lowest layer of clouds or obscuring phenomenon that is reported as "broken", "overcast", or "obscuration" and not classified as "thin" or "partial". For example, a forecast which reads "CIGS WILL BE GENLY 1 TO 2 THSD FEET" refers to heights *above ground level* (AGL). A forecast which reads "BRKN TO OVC LYRS AT 8 TO 12 THSD MSL" states that the height is *above mean sea level* (MSL).

b. Pilots usually report height values above MSL, since they determine heights by the altimeter. This is taken in account when disseminating and otherwise applying information received from pilots. ("Ceilings" heights are always above ground level.) In reports disseminated as PIREPs, height references are given the same as received from pilots, that is, above MSL. In the following example of an hourly observation, a pilot report of the heights of the bases and tops of an overcast layer in the terminal area is converted by the reporting station to reflect AGL to report the base of the overcast layer (E12). The pilot's reported top of the overcast layer (23) is not converted to AGL and is shown in the remarks section (last item) of the weather reporting (top ovc 23)

EXAMPLE:

E12 OVC 2FK 132/49//47/0000/002/TOP OVC 23

c. In aviation forecasts (Terminal, Area, or In-flight Advisories) ceilings are denoted by the prefix "C" when used with sky cover symbols as in "LWRG to C5 OVC-1TRW", or by the contraction "CIG" before, or the contraction "AGL" after, the forecast cloud height value. When the cloud base is given in height above MSL, it is so indicated by the contraction "MSL" or "ASL" following the height value. The heights of clouds tops, freezing level, icing and turbulence are always given in heights above ASL or MSL.

514. REPORTING PREVAILING VISIBILITY

a. Surface (horizontal) visibility is reported in weather observations in terms of statute miles and increments thereof (e.g., 1/16, 1/8, 1/4, 1/2, 3/4, 1, 1 1/4, etc.). Visibility is determined through the ability to see and identify preselected and prominent objects at a known distance from the usual point of observation. Visibilities which are determined to be less than 7 miles identify the obscuring atmospheric condition, (e.g., fog, haze, smoke, etc., or combinations thereof).

b. Prevailing visibility is the greatest visibility equalled or exceeded throughout at least half of the horizon circle, which need not be continuous. Segments of the horizon circle which may have a significantly lower visibility may be reported in the remarks section of the weather report (i.e., the southeastern quadrant of the horizon circle may be determined to be 2 miles in fog while the remaining quadrants are determined to be 3 miles in fog).

c. When the prevailing visibility at the usual point of observation, or at the tower level, is less than 4 miles, certificated tower personnel will take visibility observations in addition to those taken at the usual point of observation. The lower of these two values will be used as the prevailing visibility for aircraft operations.

515. ESTIMATING INTENSITY OF PRECIPITATION

a. LIGHT — Scattered drops or flakes that do not completely wet or cover an exposed surface, regardless of duration, to 0.10 inch per hour; maximum 0.01 inch in 6 minutes.

b. MODERATE — .11 inch to 0.30 inch per hour; more than 0.01 inch to 0.03 inch in 6 minutes.

c. HEAVY — More than 0.30 inch per hour; more than 0.03 inch in 6 minutes.

516. ESTIMATING INTENSITY OF DRIZZLE

a. LIGHT — Scattered drops that do not completely wet surface, regardless of duration, to 0.01 inch per hour.

b. MODERATE — More than 0.01 inch to 0.02 inch per hour.

c. HEAVY — More than 0.02 inch per hour.

517. ESTIMATING INTENSITY OF SNOW

a. LIGHT — Visibility 5/8 statute mile or more.

b. MODERATE — Visibility less than 5/8 statute mile but not less than 5/16 statute mile.

c. HEAVY — Visibility less than 5/16 statute mile.

518—519. RESERVED

520. PILOT WEATHER REPORTS (PIREP)

a. FAA air traffic facilities are required to solicit PIREPs when the following conditions are reported or forecast: Ceilings at or below 5,000 feet; Visibility at or below 5 miles; Thunderstorms and related phenomena; Icing of light degree or greater; Turbulence of moderate degree or greater; and Windshear.

b. Pilots are urged to cooperate and promptly volunteer reports of these conditions and other atmospheric data such as: Cloud bases, tops and layers; Flight visibility; Precipitation; Visibility restrictions such as haze, smoke and dust; Wind at altitude; and Temperature aloft.

c. PIREPs should be given to the ground facility with which communications are established, i.e., EFAS, FSS, ARTCC or terminal ATC. One of the primary duties of EFAS facilities, radio call "FLIGHT WATCH", is to serve as a collection point for the exchange of PIREPs with en route aircraft.

d. If pilots are not able to make PIREPs by radio, reporting upon landing of the in-flight conditions encountered to the nearest FSS or Weather Service Office will be helpful. Some of the uses made of the reports are:

(1) The ATCT uses the reports to expedite the flow of air traffic in the vicinity of the field and for hazardous weather avoidance procedures.

(2) The FSS uses the reports to brief other pilots, to provide in-flight advisories, and weather avoidance information to en route aircraft.

(3) The ARTCC uses the reports to expedite the flow of en route traffic, to determine most favorable altitudes, and to issue hazardous weather information within the center's area.

(4) The NWS uses the reports to verify or amend conditions contained in aviation forecast and advisories. In some cases, pilot reports of hazardous conditions are the triggering mechanism for the issuance of advisories. They also use the reports for pilot weather briefings.

(5) The NWS, other government organizations, the military, and private industry groups use PIREPs for research activities in the study of meteorological phenomena.

(6) All air traffic facilities and the NWS forward the reports received from pilots into the weather distribution system to assure the information is made available to all pilots and other interested parties.

e. The FAA, NWS, and other organizations that enter PIREPs into the weather reporting system use the format listed below. Items 1 through 6 are included in all transmitted PIREPs along with one or more of items 7 through 13. Although the PIREP should be as complete and concise as possible, pilots should not be overly concerned with strict format or phraseology. The important thing is that the information is relayed so other pilots may benefit from your observation. If a portion of the report needs clarification, the ground station will request the information.

	PIREP ELEMENTS	PIREP CODE	CONTENTS
1.	3-letter station identifier	XXX	Nearest weather reporting location to the reported phenomena
2.	Report type	UA or UUA	Routine or Urgent PIREP
3.	Location	/OV	In relation to a VOR
4.	Time	/TM	Coordinated Universal Time
5.	Altitude	/FL	Essential for turbulence and icing reports
6.	Type Aircraft	/TP	Essential for turbulence and icing reports
7.	Sky cover	/SK	Cloud height and coverage (scattered, broken, or overcast)
8.	Weather	/WX	Flight visibility, precipitation, restrictions to visibility, etc.
9.	Temperature	/TA	Degrees Celsius
10.	Wind	/WV	Direction in degrees magnetic and speed in knots
11.	Turbulence	/TB	See paragraph 522
12.	Icing	/IC	See paragraph 521
13.	Remarks	/RM	For reporting elements not included or to clarify previously reported items

Completed PIREPs will be transmitted to weather circuits as in the following examples:

CMH UA /OV APE 230010/TM 1516/FL085/TP BE80/ SK BKN 065/WX FV03 H K/TA 20/TB LGT

Translation: One zero miles southwest of Appleton VOR; Time 1516 UTC; Altitude eight thousand five hundred; Aircraft type BE80; Top of the broken cloud layer is six thousand five hundred; Flight visibility 3 miles with haze and smoke; Air Temperature 20 degrees Celsius; Light turbulence.

CRW UV /OV BKW 360015-CRW/TM 1815/FL120//TP BE99/SK OVC/WX R/TA -08 /WV 290030/TB LGT-MDT/ IC LGT RIME/RM MDT MXD ICG DURGC ROA NWBND FL080-100 1750

Translation: From 15 miles north of Beckley VOR to Charleston VOR; Time 1815 UTC; Altitude 12,000 feet; Type aircraft, BE-99; In clouds; Rain; Temperature -08 Celsius; Wind 290 degrees magnetic at 30 knots; Light to moderate turbulence; Light Rime Icing; Encountered moderate mixed icing during climb northwestbound from Roanoke Va between 8000 and 10,000 feet at 1750 UTC.

521. PIREPS RELATING TO AIRFRAME ICING

a. The effects of ice on aircraft are cumulative — Thrust is reduced, Drag increases, Lift lessens, Weight increases. The results are an increase in stall speed and a deterioration of aircraft performance. In extreme cases, 2 to 3 inches of ice can form on the leading edge of the airfoil in less than 5 minutes. It takes but 1/2 inch of ice to reduce the lifting power of some aircraft by 50 percent and increases the frictional drag by an equal percentage.

b. A pilot can expect icing when flying in visible precipitation such as rain or cloud droplets, and the temperature is 0 degrees Celsius or colder. When icing is detected, a pilot should do one of two things (particularly if the aircraft is not equipped with deicing equipment), he should get out of the area of precipitation or go to an altitude where the temperature is above freezing. This "warmer" altitude may not always be a lower altitude. Proper preflight action includes obtaining information on the freezing level and the above-freezing levels in precipitation areas. Report icing to ATC/FSS, and if operating IFR, request new routing or altitude if icing will be a hazard. Be sure to give type of aircraft to ATC when reporting icing. The following describes how to report icing conditions.

(1) Trace — Ice becomes perceptible. Rate of accumulation is slightly greater than the rate of sublimation. It is not hazardous even though deicing/anti-icing equipment is not utilized, unless encountered for an extended period of time (over 1 hour).

(2) Light — The rate of accumulation may create a problem if flight is prolonged in this environment (over 1 hour). Occasional use of deicing/anti-icing equipment removes/prevents accumulation. It does not present a problem if the deicing/anti-icing equipment is used.

(3) Moderate — The rate of accumulation is such that even short encounters become potentially hazardous and use of deicing/anti-icing equipment or flight diversion is necessary.

(4) Severe — The rate of accumulation is such that deicing/anti-icing equipment fails to reduce or control the hazard. Immediate flight diversion is necessary.

EXAMPLE:

Pilot Report: Give Aircraft Identification, Location, Time (UTC), Intensity of Type, Altitude/FL, Aircraft Type, IAS, and Outside Air Temperature.

NOTE 1.—Rime Ice: Rough, milky, opaque ice formed by the instantaneous freezing of small supercooled water droplets

NOTE 2.—Clear Ice: A glossy, clear, or translucent ice formed by the relatively slow freezing of large supercooled water droplets.

NOTE 3.—The Outside Air Temperature should be requested by the FSS/ATC if not included in the PIREP.

522. PIREPS RELATING TO TURBULENCE

a. When encountering turbulence, pilots are urgently requested to report such conditions to ATC as soon as practicable. PIREPs relating to turbulence should state:

(1) Aircraft location.

(2) Time of occurrence in UTC.

(3) Turbulence intensity.

(4) Whether the turbulence occurred in or near clouds.

(5) Aircraft altitude, or Flight Level.

(6) Type of Aircraft.

(7) Duration of turbulence.

EXAMPLE:

OVER OMAHA, 1232Z, MODERATE TURBULENCE IN CLOUDS AT FLIGHT LEVEL THREE ONE ZERO, BOEING 707.

EXAMPLE:

FROM FIVE ZERO MILES SOUTH OF ALBUQUERQUE TO THREE ZERO MILES NORTH OF PHOENIX, 1250Z, OCCASIONAL MODERATE CHOP AT FLIGHT LEVEL THREE THREE ZERO, DC8.

b. Duration and classification of intensity should be made using the following table:

TURBULENCE REPORTING CRITERIA TABLE

INTENSITY	AIRCRAFT REACTION	REACTION INSIDE AIRCRAFT	REPORTING TERM-DEFINITION
Light	Turbulence that momentarily causes slight, erratic changes in altitude and/or attitude (pitch, roll, yaw). Report as **Light Turbulence**;* or Turbulence that causes slight, rapid and somewhat rhythmic bumpiness without appreciable changes in altitude or attitude. Report as **Light Chop**.	Occupants may feel a slight strain against seat belts or shoulder straps. Unsecured objects may be displaced slightly. Food service may be conducted and little or no difficulty is encountered in walking.	Occasional - Less than 1/3 of the time. Intermittent - 1/3 to 2/3. Continuous - More than 2/3.
Moderate	Turbulence that is similar to Light Turbulence but of greater intensity. Changes in altitude and/or attitude occur but the aircraft remains in positive control at all times. It usually causes variations in indicated airspeed. Report as **Moderate Turbulence**;* or Turbulence that is similar to Light Chop but of greater intensity. It causes rapid bumps or jolts without appreciable changes in aircraft altitude or attitude. Report as **Moderate Chop**.	Occupants feel definite strains against seat belts or shoulder straps. Unsecured objects are dislodged. Food service and walking are difficult.	**NOTE** 1. Pilots should report location(s), time (UTC), intensity, whether in or near clouds, altitude, type of aircraft and, when applicable, duration of turbulence. 2. Duration may be based on time between two locations or over a single location. All locations should be readily identifiable. EXAMPLES: a. Over Omaha, 1232Z, Moderate Turbulence, in cloud, Flight Level 310, B707. b. From 50 miles south of Albuquerque to 30 miles north of Phoenix, 1210Z to 1250Z, occasional Moderate Chop, Flight Level 330, DC8.
Severe	Turbulence that causes large, abrupt changes in altitude and/or attitude. It usually causes large variations in indicated airspeed. Aircraft may be momentarily out of control. Report as **Severe Turbulence**. *	Occupants are forced violently against seat belts or shoulder straps. Unsecured objects are tossed about. Food service and walking are impossible.	
Extreme	Turbulence in which the aircraft is violently tossed about and is practically impossible to control. It may cause structural damage. Report as **Extreme Turbulence**.*		

* High level turbulence (normally above 15,000 feet ASL) not associated with cumuliform cloudiness, including thunderstorms, should be reported as CAT (clear air turbulence) preceded by the appropriate intensity, or light or moderate chop.

523. WIND SHEAR PIREPS

a. Because unexpected changes in wind speed and direction can be hazardous to aircraft operations at low altitudes on approach to and departing from airports, pilots are urged to promptly volunteer reports to controllers of wind shear conditions they encounter. An advance warning of this information will assist other pilots in avoiding or coping with a wind shear on approach or departure.

b. When describing conditions, use of the terms "negative" or "positive" wind shear should be avoided. PIREPs of "*negative* wind shear on final," intended to describe loss of airspeed and lift, have been interpreted to mean that *no* wind shear was encountered. The recommended method for wind shear reporting is to state the loss or gain of airspeed and the altitudes at which it was encountered.

EXAMPLE:

DENVER TOWER, CESSNA 1234 ENCOUNTERED WIND SHEAR, LOSS OF 20 KNOTS AT 400 FEET.

EXAMPLE:

TULSA TOWER, AMERICAN 721 ENCOUNTERED WIND SHEAR ON FINAL, GAINED 25 KNOTS BETWEEN 600 AND 400 FEET FOLLOWED BY LOSS OF 40 KNOTS BETWEEN 400 FEET AND SURFACE.

(1) Pilots who are not able to report wind shear in these specific terms are encouraged to make reports in terms of the effect upon their aircraft.

EXAMPLE:

MIAMI TOWER, GULFSTREAM 403 CHARLIE ENCOUNTERED AN ABRUPT WIND SHEAR AT 800 FEET ON FINAL, MAX THRUST REQUIRED.

(2) Pilots using Inertial Navigation Systems should report the wind and altitude both above and below the shear level.

524. CLEAR AIR TURBULENCE (CAT) PIREPS

CAT has become a very serious operational factor to flight operations at all levels and especially to jet traffic flying in excess of 15,000 feet. The best available information on this phenomena must come from pilots via the PIREP reporting procedures. All pilots encountering CAT conditions are urgently requested to report *time, location* and *intensity* (light, moderate, severe or extreme) of the element to the FAA facility with which they are maintaining radio contact. If time and conditions permit, elements should be reported according to the standards for other

PIREPs and position reports. (See PARA—522 - PIREPS RELATING TO TURBULENCE.)

525. MICROBURSTS

a. Relatively recent meteorological studies have confirmed the existence of microburst phenomena. Microburst are small-scale intense downdrafts which, on reaching the surface, spread outward in all directions from the downdraft center. This causes the presence of both vertical and horizontal wind shears that can be extremely hazardous to all types and categories of aircraft, especially at low altitudes. Due to their small size, short life-span, and the fact that they can occur over areas without surface precipitation, microbursts are not easily detectable using conventional weather radar or wind shear alert systems.

b. Parent clouds producing microburst activity can be any of the low or middle layer convective cloud types. Note, however, that microbursts commonly occur within the heavy rain portion of thunderstorms, and in much weaker, benign-appearing convective cells that have little or no precipitation reaching the ground.

c. The life cycle of a microburst as it descends in a convective rain shaft is seen in Figure 1. An important consideration for pilots is the fact that the microburst intensifies for about 5 minutes after it strikes the ground.

d. Characteristics of microbursts include:

(1) Size — The microburst downdraft is typically less than 1 mile in diameter as it descends from the cloud base to about 1,000 - 3,000 feet above the ground. In the transition zone near the ground, the downdraft changes to a horizontal outflow that can extend to approximately 2 1/2 miles in diameter.

(2) Intensity — The downdrafts can be as strong as 6,000 feet per minute. Horizontal winds near the surface can be as strong as 45 knots resulting in a 90 knot shear (headwind to tailwind change for a traversing aircraft) across the microburst. These strong horizontal winds occur within a few hundred feet of the ground.

(3) Visual Signs — Microbursts can be found almost anywhere that there is convective activity. They may be embedded in heavy rain associated with a thunderstorm or in light rain in benign-appearing virga. When there is little or no precipitation at the surface accompanying the microburst, a ring of blowing dust may be the only visual clue of its existence.

(4) Duration — An individual microburst will seldom last longer than 15 minutes from the time it strikes the ground until dissipation. The horizontal winds continue to increase during the first 5 minutes with the maximum intensity winds lasting approximately 2- 4- minutes. Sometimes microbursts are concentrated into a line structure and, under these conditions, activity may continue for as long as an hour. Once microburst activity starts, multiple microbursts in the same general area are not uncommon and should be expected.

e. Microburst wind shear may create a severe hazard for aircraft within 1,000 feet of the ground, particularly during the approach to landing and landing and take-off phases. The impact of a microburst on aircraft which have the unfortunate experience of penetrating one is characterized in Figure 2. The aircraft may encounter a headwind (performance increasing), followed by a downdraft and tailwind (both performance decreasing), possibly resulting in terrain impact.

f. Pilots should heed wind shear PIREPS, as a previous pilot's encounter with a microburst may be the only indication received. However, since the wind shear intensifies rapidly in its early stages a PIREP may not indicate the current severity of a microburst. Flight in the vicinity of suspected or reported microburst activity should always be avoided. Should a pilot encounter one, a wind shear PIREP should be made at once.

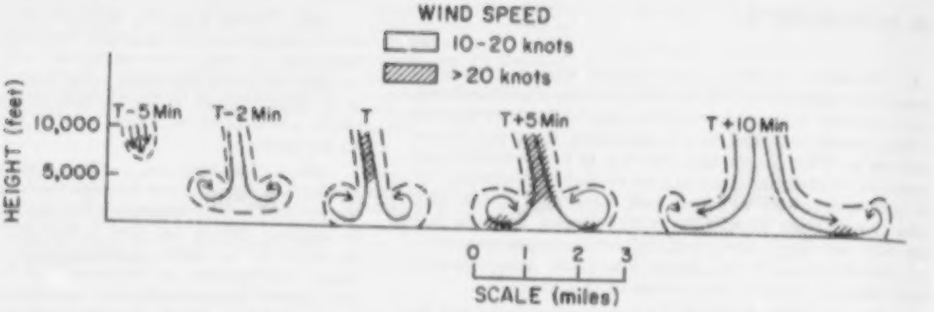

WIND SPEED
10-20 knots
>20 knots
HEIGHT (feet)
10,000
5,000
T-5 Min
T-2 Min
T
T+5 Min
T+10 Min
0
1
2
3
SCALE (miles)

Figure 1. Vertical cross section of the evolution of a microburst wind field. T is the time of initial divergence at the surface. The shading refers to the vector wind speeds. Figure adapted from Wilson et al., 1984, Microburst Wind Structure and Evaluation of Doppler Radar for Wind Shear Detection, DOT/FAA Report No. DOT/FAA/PM-84/29, National Technical Information Service, Springfield, VA 37 pp.

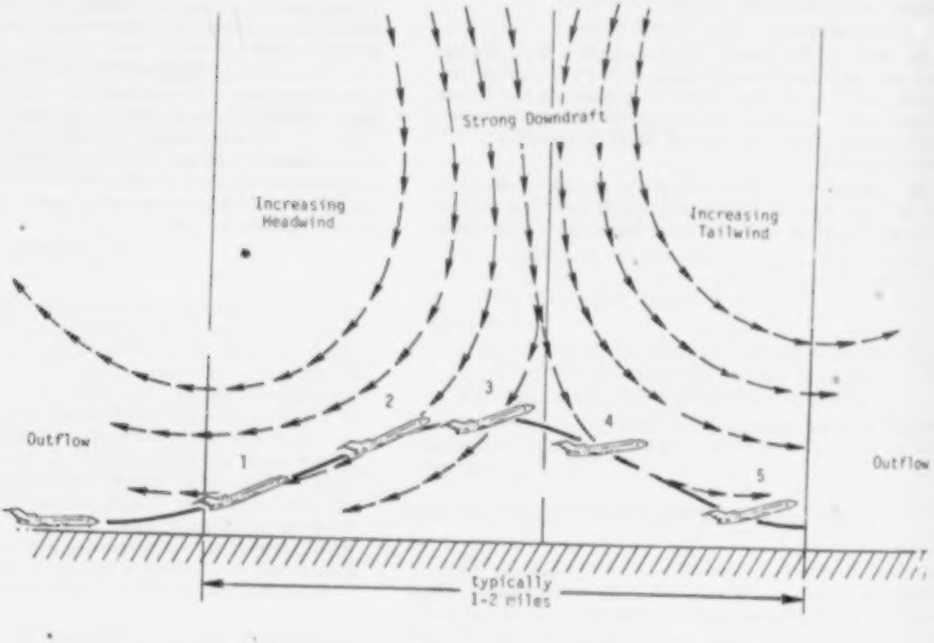

Strong Downdraft
Increasing Headwind
Increasing Tailwind
Outflow
Outflow
1
2
3
4
5
typically 1-2 miles

Figure 2. A microburst encounter during takeoff. The airplane first encounters a headwind and experiences increasing performance (1), this is followed in short succession by a decreasing headwind component (2), a downdraft (3), and finally a strong tailwind (4), where 2 through 5 all result in decreasing performance of the airplane. Position (5) represents an extreme situation just prior to impact. Figure courtesy of Walter Frost, FWG Associates, Inc., Tullahoma, Tennessee.

526. THUNDERSTORMS

a. Turbulence, hail, rain, snow, lightning, sustained updrafts and downdrafts, icing conditions — all are present in thunderstorms. While there is some evidence that maximum turbulence exists at the middle level of a thunderstorm, recent studies show little variation of turbulence intensity with altitude.

b. There is no useful correlation between the external visual appearance of thunderstorms and the severity or amount of turbulence or hail within them. The visible thunderstorm cloud is only a portion of a turbulent system whose updrafts and downdrafts often extend far beyond the visible storm cloud. Severe turbulence can be expected up to 20 miles from severe thunderstorms. This distance decreases to about 10 miles in less severe storms.

c. Weather radar, airborne or ground based, will normally reflect the areas of moderate to heavy precipitation (radar does not detect turbulence). The frequency and severity of turbulence generally increases with the radar reflectivity which is closely associated with the areas of highest liquid water content of the storm. NO FLIGHT PATH THROUGH AN AREA OF STRONG OR VERY STRONG RADAR ECHOS SEPARATED BY 20-30 MILES OR LESS MAY BE CONSIDERED FREE OF SEVERE TURBULENCE.

d. Turbulence beneath a thunderstorm should not be minimized. This is especially true when the relative humidity is low in any layer between the surface and 15,000 feet. Then the lower altitudes may be characterized by strong out-flowing winds and severe turbulence.

e. The probability of lightning strikes occurring to aircraft is greatest when operating at altitudes where temperatures are between minus 5 degrees Celsius and plus 5 degrees Celsius. Lightning can strike aircraft flying in the clear in the vicinity of a thunderstorm.

f. The NWS recognizes only two classes of intensities of thunderstorms as applied to aviation surface weather observations:

(1) Thunderstorm T;

(2) Severe T+

g. NWS radar systems are able to objectively determine radar weather echo intensity levels by use of Video Integrator Processor (VIP) equipment. These thunderstorm intensity levels are on a scale of one to six. (See RADAR WEATHER ECHO INTENSITY LEVELS in the Pilot/Controller Glossary.)

EXAMPLE:

Alert provided by an ATC facility to an aircraft: (aircraft identification) LEVEL FIVE INTENSE WEATHER ECHO BETWEEN TEN O'CLOCK AND TWO O'CLOCK, ONE ZERO MILES MOVING EAST AT TWO ZERO KNOTS, TOP FLIGHT LEVEL THREE NINE ZERO.

EXAMPLE:

Alert provided by a FSS. (aircraft identification) LEVEL FIVE INTENSE WEATHER ECHO TWO ZERO MILES WEST OF ATLANTA VOR TWO FIVE MILES WIDE, MOVING EAST AT TWO ZERO KNOTS, TOPS FLIGHT LEVEL THREE NINE ZERO.

527. THUNDERSTORM FLYING

a. Above all, remember this: never regard any thunderstorm "lightly" even when radar observers report the echoes are of light intensity. Avoiding thunderstorms is the best policy. Following are some Do's and Don'ts of thunderstorm avoidance:

(1) Don't land or takeoff in the face of an approaching thunderstorm. A sudden gust front of low level turbulence could cause loss of control.

(2) Don't attempt to fly under a thunderstorm even if you can see through to the other side. Turbulence and wind shear under the storm could be disastrous.

(3) Don't fly without airborne radar into a cloud mass containing scattered embedded thunderstorms. Scattered thunderstorms not embedded usually can be visually circumnavigated.

(4) Don't trust the visual appearance to be a reliable indicator of the turbulence inside a thunderstorm.

(5) Do avoid by at least 20 miles any thunderstorm identified as severe or giving an intense radar echo This is especially true under the anvil of a large cumulonimbus.

(6) Do clear the top of a known or suspected severe thunderstorm by at least 1,000 feet altitude for each 10 knots of wind speed at the cloud top. This should exceed the altitude capability of most aircraft.

(7) Do circumnavigate the entire area if the area has 6/10 thunderstorm coverage.

(8) Do remember that vivid and frequent lightning indicates the probability of a severe thunderstorm.

(9) Do regard as extremely hazardous any thunderstorm with tops 35,000 feet or higher whether the top is visually sighted or determined by radar.

b. If you cannot avoid penetrating a thunderstorm, following are some Do's *before* entering the storm:

(1) Tighten your safety belt, put on your shoulder harness if you have one and secure all loose objects.

(2) Plan and hold your course to take you through the storm in a minimum time.

(3) To avoid the most critical icing, establish a penetration altitude below the freezing level or above the level of minus 15 degrees Celsius.

(4) Verify that pitot heat is on and turn on carburetor heat or jet engine anti-ice. Icing can be rapid at any altitude and cause almost instantaneous power failure and/or loss of airspeed indication.

(5) Establish power settings for turbulence penetration airspeed recommended in your aircraft manual.

(6) Turn up cockpit lights to highest intensity to lessen temporary blindness from lightning.

(7) If using automatic pilot, disengage altitude hold mode and speed hold mode. The automatic altitude and speed controls will increase maneuvers of the aircraft thus increasing structural stress.

(8) If using airborne radar, tilt the antenna up and down occasionally. This will permit you to detect other thunderstorm activity at altitudes other than the one being flown.

c. Following are some Do's and Don'ts *during* the thunderstorm penetration:

READEX FICHE best copy available

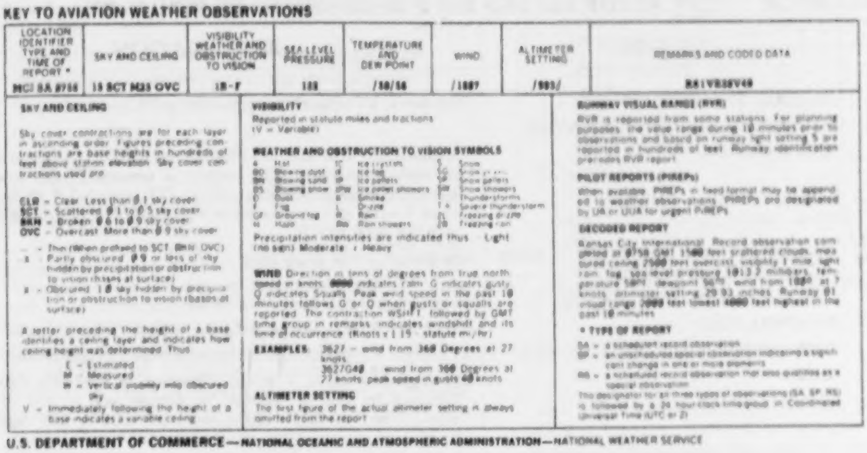
(1) Do keep your eyes on your instruments. Looking outside the cockpit can increase danger of temporary blindness from lightning.

(2) Don't change power settings; maintain settings for the recommended turbulence penetration airspeed.

(3) Do maintain constant attitude; let the aircraft "ride the waves." Manuevers in trying to maintain constant altitude increases stress on the aircraft.

(4) Don't turn back once you are in the thunderstorm. A straight course through the storm most likely will get you out of the hazards most quickly. In addition, turning maneuvers increase stress on the aircraft.

528. KEY TO AVIATION WEATHER OBSERVATIONS AND FORECASTS



KEY TO AVIATION WEATHER OBSERVATIONS

LOCATION IDENTIFIER TYPE AND TIME OF REPORT *	SKY AND CEILING	VISIBILITY WEATHER AND OBSTRUCTION TO VISION	SEA LEVEL PRESSURE	TEMPERATURE AND DEW POINT	WIND	ALTIMETER SETTING	REMARKS AND CODED DATA
MCI SA 0758	15 SCT M25 OVC	1R-F	132	/58/56	/1807	/993/	R01VR20V40

SKY AND CEILING

Sky cover contractions are for each layer in ascending order. Figures preceding contractions are base heights in hundreds of feet above station elevation. Sky cover contractions used are:

CLR = Clear: Less than 0.1 sky cover
SCT = Scattered: 0.1 to 0.5 sky cover
BKN = Broken: 0.6 to 0.9 sky cover
OVC = Overcast: More than 0.9 sky cover

- = Thin (When prefixed to SCT, BKN, OVC)
-X = Partly obscured: 0.9 or less of sky hidden by precipitation or obstruction to vision (bases at surface)
X = Obscured: 1.0 sky hidden by precipitation or obstruction to vision (bases at surface)

A letter preceding the height of a base identifies a ceiling layer and indicates how ceiling height was determined. Thus:

E = Estimated
M = Measured
W = Vertical visibility into obscured sky
V = Immediately following the height of a base indicates a variable ceiling

VISIBILITY

Reported in statute miles and fractions (V = Variable)

WEATHER AND OBSTRUCTION TO VISION SYMBOLS

A	Hail	IC	Ice crystals	S	Snow
BD	Blowing dust	IF	Ice fog	SG	Snow grains
BN	Blowing sand	IP	Ice pellets	SP	Snow pellets
BS	Blowing snow	IPW	Ice pellet showers	SW	Snow showers
D	Dust	K	Smoke	T	Thunderstorms
F	Fog	L	Drizzle	T+	Severe thunderstorm
GF	Ground fog	R	Rain	ZL	Freezing drizzle
H	Haze	RW	Rain showers	ZR	Freezing rain

Precipitation intensities are indicated thus: - Light; (no sign) Moderate; + Heavy

WIND Direction in tens of degrees from true north, speed in knots. 0000 indicates calm. G indicates gusty. Q indicates Squalls. Peak wind speed in the past 10 minutes follows G or Q when gusts or squalls are reported. The contraction WSHFT, followed by GMT time group in remarks, indicates windshift and its time of occurrence. (Knots x 1.15 = statute mi/hr)

EXAMPLES: 3627 = wind from 360 Degrees at 27 knots
3627G40 = wind from 360 Degrees at 27 knots, peak speed in gusts 40 knots

ALTIMETER SETTING

The first figure of the actual altimeter setting is always omitted from the report.

RUNWAY VISUAL RANGE (RVR)

RVR is reported from some stations. For planning purposes, the value range during 10 minutes prior to observations and based on runway light setting 5 are reported in hundreds of feet. Runway identification precedes RVR report.

PILOT REPORTS (PIREPs)

When available, PIREPs in fixed format may be appended to weather observations. PIREPs are designated by UA or UUA for urgent PIREPs.

DECODED REPORT

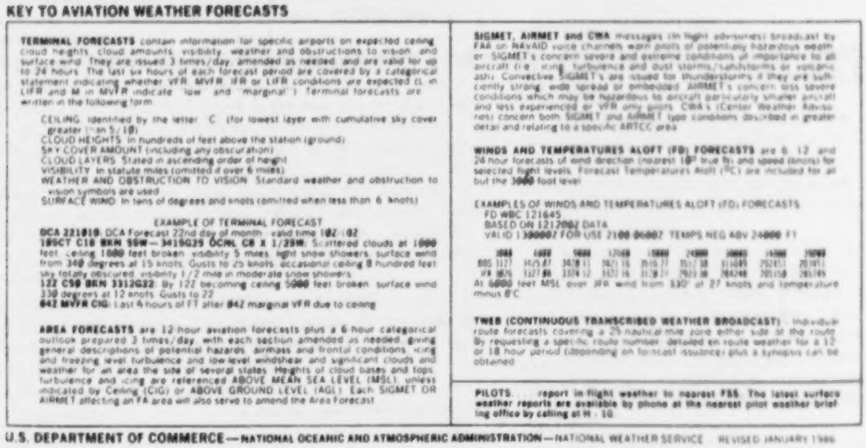
Kansas City International: Record observation completed at 0758 GMT, 1500 feet scattered clouds, measured ceiling 2500 feet overcast, visibility 1 mile, light rain, fog, sea-level pressure 1013.2 millibars, temperature 58°F, dewpoint 56°F, wind from 180°, at 7 knots, altimeter setting 29.93 inches. Runway 01 visual range 2000 feet lowest, 4000 feet highest in the past 10 minutes.

*** TYPE OF REPORT**

SA = a scheduled record observation
SP = an unscheduled special observation indicating a significant change in one or more elements
RS = a scheduled record observation that also qualifies as a special observation

The designator for all three types of observations (SA, SP, RS) is followed by a 24-hour-clock-time-group in Coordinated Universal Time (UTC or Z).

U.S. DEPARTMENT OF COMMERCE—NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION—NATIONAL WEATHER SERVICE



KEY TO AVIATION WEATHER FORECASTS

TERMINAL FORECASTS contain information for specific airports on expected ceiling, cloud heights, cloud amounts, visibility, weather and obstructions to vision and surface wind. They are issued 3 times/day, amended as needed, and are valid for up to 24 hours. The last six hours of each forecast period are covered by a categorical statement indicating whether VFR, MVFR, IFR or LIFR conditions are expected (L in LIFR and M in MVFR indicate "low" and "marginal"). Terminal forecasts are written in the following form:

CEILING: Identified by the letter "C" (for lowest layer with cumulative sky cover greater than 5/10)
CLOUD HEIGHTS: In hundreds of feet above the station (ground)
SKY COVER AMOUNT (including any obscuration)
CLOUD LAYERS: Stated in ascending order of height
VISIBILITY: In statute miles (omitted if over 6 miles)
WEATHER AND OBSTRUCTION TO VISION: Standard weather and obstruction to vision symbols are used
SURFACE WIND: In tens of degrees and knots (omitted when less than 6 knots)

EXAMPLE OF TERMINAL FORECAST

DCA 221010: DCA Forecast 22nd day of month—valid time 10Z–10Z.
10SCT C18 BKN 5SW- 3415G25 OCNL C8 X 1/2SW: Scattered clouds at 1000 feet, ceiling 1800 feet broken, visibility 5 miles, light snow showers, surface wind from 340 degrees at 15 knots, Gusts to 25 knots, occasional ceiling 8 hundred feet sky totally obscured, visibility 1/2 mile in moderate snow showers.
12Z C50 BKN 3312G22: By 12Z becoming ceiling 5000 feet broken, surface wind 330 degrees at 12 knots, Gusts to 22.
04Z MVFR CIG: Last 6 hours of FT after 04Z marginal VFR due to ceiling.

AREA FORECASTS are 12 hour aviation forecasts plus a 6 hour categorical outlook prepared 3 times/day, with each section amended as needed, giving general descriptions of potential hazards, airmass and frontal conditions, icing and freezing level, turbulence and low-level windshear, and significant clouds and weather for an area the size of several states. Heights of cloud bases and tops, turbulence and icing are referenced ABOVE MEAN SEA LEVEL (MSL), unless indicated by Ceiling (CIG) or ABOVE GROUND LEVEL (AGL). Each SIGMET OR AIRMET affecting an FA area will also serve to amend the Area Forecast.

SIGMET, AIRMET and CWA messages (in-flight advisories) broadcast by FAA on NAVAID voice channels warn pilots of potentially hazardous weather. SIGMET's concern severe and extreme conditions of importance to all aircraft (i.e., icing, turbulence and dust storms/sandstorms or volcanic ash). Convective SIGMET's are issued for thunderstorms if they are sufficiently strong, wide spread or embedded. AIRMET's concern less severe conditions which may be hazardous to aircraft, particularly smaller aircraft and less experienced or VFR-only pilots. CWA's (Center Weather Advisories) concern both SIGMET and AIRMET type conditions described in greater detail and relating to a specific ARTCC area.

WINDS AND TEMPERATURES ALOFT (FD) FORECASTS are 6, 12, and 24 hour forecasts of wind direction (nearest 10° true N) and speed (knots) for selected flight levels. Forecast Temperatures Aloft (°C) are included for all but the 3000 foot level.

EXAMPLES OF WINDS AND TEMPERATURES ALOFT (FD) FORECASTS
FD WBC 121645
BASED ON 121200Z DATA
VALID 130000Z FOR USE 2100-0600Z. TEMPS NEG ABV 24000 FT

	3000	6000	9000	12000	18000	24000	30000	34000	39000
BOS	3127	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
JFK	3026	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

At 6000 feet MSL over JFK wind from 330° at 27 knots and temperature minus 8°C.

TWEB (CONTINUOUS TRANSCRIBED WEATHER BROADCAST)—Individual route forecasts covering a 25 nautical mile zone either side of the route. By requesting a specific route number, detailed en route weather for a 12 or 18 hour period (depending on forecast issuance) plus a synopsis can be obtained.

PILOTS . . . report in-flight weather to nearest FSS. The latest surface weather reports are available by phone at the nearest pilot weather briefing office by calling at H + 10.

U.S. DEPARTMENT OF COMMERCE—NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION—NATIONAL WEATHER SERVICE REVISED JANUARY 1986

529. AUTOB DECODING KEY

DECODING OBSERVATIONS FROM AUTOB STATIONS

EXAMPLE: **ENV AUTOB E25 BKN BV7 P 33/29/3606/975 PK WND 08 001**

ENCODE	DECODE	EXPLANATION
ENV	STATION IDENTIFICATION:	(Wendover, UT) Identifies report using FAA identifiers.
AUTOB	AUTOMATIC STATION IDENTIFIER	
E25 BKN	SKY & CEILING:	(Estimated 2500 ft. broken) Figures are height in 100s of feet above ground. Contraction after height is amount of sky cover. Letter preceding height indicates ceiling. WX reported if visibility is less than 2 miles and no clouds are detected. *NO CLOUDS REPORTED ABOVE 6000 FEET.*
BV7	BACKSCATTER VISIBILITY AVERAGED IN PAST MINUTE:	Reported in whole miles from 1 to 7.
P	PRECIPITATION OCCURRENCE:	(P=precipitation in past 10 minutes).
33	TEMPERATURE:	(33 degrees F.) Minus sign indicates sub-zero temperatures.
/29	DEW POINT:	(29 degrees F.) Minus sign indicates sub-zero temperatures.
/3606	WIND:	(360 degrees true at 6 knots) Direction is first two digits and is reported in tens of degrees. To decode, add a zero to first two digits. The last digits are speed; e.g., 2524 = 250 degrees at 24 knots.
/975	ALTIMETER SETTING:	(29.75 inches) The tens digit and decimal are omitted from report. To decode, prefix a 2 to code if it begins with 8 or 9. Otherwise, prefix a 3; e.g., 982 = 29.82, 017 = 30.17.
PK WND 08	PEAK WIND SPEED:	(8 knots) Reported speed is highest detected since last hourly observation.
001	PRECIPITATION ACCUMULATION:	(0.01 inches) Amount of precipitation since last synoptic time (00, 06, 12, 1800 UTC).

NOTE: If no clouds are detected below 6,000 feet and the visibility is greater than 2 miles, the reported sky condition will be *CLR BLO 60.*

Section 2. ALTIMETER SETTING PROCEDURES

530. GENERAL

a. The accuracy of aircraft altimeters is subject to the following factors:

(1) Nonstandard temperatures of the atmosphere.

(2) Aircraft static pressure systems (position error).

(3) Nonstandard atmospheric pressure, and

(4) Instrument error.

b. Pilots should disregard the effect of nonstandard atmospheric temperatures and pressures except that low temperatures and pressures need to be considered for terrain clearance purposes.

NOTE.— Standard temperature at sea level is 15 degrees Celsius (59 degrees Fahrenheit). The temperature gradient from sea level is 2 degrees Celsius (3.6 degrees Fahrenheit) per 1,000 feet. Pilots should apply corrections for static pressure systems and/or instruments, if appreciable errors exist.

c. Experience gained through volume of operations has led to the adoption of a standard altimeter setting for flights operating in the higher altitudes. A standard setting eliminates altitude conflicts caused by altimeter settings derived from different geographical sources. In addition, it eliminates station barometer errors and some of the altimeter instrument errors.

531. PROCEDURES

a. The cruising altitude or flight level of aircraft shall be maintained by reference to an altimeter which shall be set, when operating:

(1) **Below 18,000 feet MSL —** to the current reported altimeter setting of a station along the route and within 100 NM of the aircraft, or if there is no station within this area, the current reported altimeter setting of an appropriate available station. When an aircraft is en route on an instrument flight plan, the ATC controller will furnish this information to the pilot at least once while the aircraft is in his area of jurisdiction. In the case of an aircraft not equipped with a radio, set to the elevation of the departure airport or use an appropriate altimeter setting available prior to departure.

(2) **At or above 18,000 feet MSL —** to 29.92 inches of mercury (standard setting). The lowest usable flight level is determined by the atmospheric pressure in the area of operation as shown in the following table:

Altimeter Setting (Current Reported)...	Lowest usable flight level
29.92 or higher	180
29.91 to 29.42	185
29.41 to 28.92	190
28.91 to 28.42	195
28.41 to 27.92	200

(3) Where the minimum altitude, as prescribed in FAR—91.109 and FAR—91.119, is above 18,000 feet MSL, the lowest usable flight level shall be the flight level equivalent of the minimum altitude plus the number of feet specified in the following table:

Altimeter Setting...	Correction Factor
29.92 or higher	none
29.91 to 29.42	500 Feet
29.41 to 28.92	1000 Feet
28.91 to 28.42	1500 Feet
28.41 to 27.92	2000 Feet
27.91 to 27.42	2500 Feet

EXAMPLE:

The minimum safe altitude of a route is 19,000 feet MSL and the altimeter setting is reported between 29.92 and 29.42 inches of mercury, the lowest usable flight level will be 195, which is the flight level equivalent of 19,500 feet MSL (minimum altitude plus 500 feet).

532. ALTIMETER ERRORS

a. Most pressure altimeters are subject to mechanical, elastic, temperature, and installation errors. (Detailed information regarding the use of pressure altitmeters is found in the Instrument Flying Handbook, Chapter IV.) Although manufacturing and installation specifications, as well as the periodic test and inspections required by regulations (Far 43, Appendix E), act to reduce these errors, any scale error may be observed in the following manner:

(1) Set the current reported altimeter setting on the altimeter setting scale.

(2) Altimeter should now read field elevation if you are located on the same reference level used to establish the altimeter setting.

(3) Note the variation between the known field elevation and the altimeter indication. If this variation is in the order of plus or minus 75 feet, the accuracy of the altimeter is questionable and the problem should be referred to an appropriately rated repair station for evaluation and possible correction.

b. Once in flight, it is very important to frequently obtain current altimeter settings en route. If you do not reset your altimeter when flying *from* an area of high pressure or high temperatures *into* an area of low pressures or low temperature, *your aircraft will be closer to the surface than the altimeter indicates.* An inch error on the altimeter equals 1,000 feet of altitude. To quote an old saying: **"GOING FROM A HIGH TO A LOW, LOOK OUT BELOW."**

c. A reverse situation, without resetting the altimeter when going from a low temperature or low pressure area into a high temperature or high pressure area, the aircraft will be higher than the altimeter indicates.

d. The possible results of the above situations is obvious, particularly if operating at the minimum altitude or when conducting an instrument approach. If the altimeter is in error, you may still be on instruments when reaching

the minimum altitude (as indicated on the altimeter), whereas you might have been in the clear and able to complete the approach if the altimeter setting was correct.

533. HIGH BAROMETRIC PRESSURE

a. Cold, dry air masses may produce barometric pressures in excess of 31.00 inches of Mercury. Most altimeters do not have an accurate means of being adjusted for altimeter settings of these levels.

b. The altimeter setting announced by air traffic controllers will be 31.00 inches of Mercury (Three One Zero Zero) when the barometric pressure equals or exceeds that value. Actual barometric pressure will be provided upon request.

c. The altimeter error caused by the high pressure will be in the opposite direction to the error caused by the cold temperature.

534—539. RESERVED

Section 3. WAKE TURBULENCE

540. GENERAL

a. Every aircraft generates a wake while in flight. Initially, when pilots encountered this wake in flight, the disturbance was attributed to "prop wash." It is known, however, that this disturbance is caused by a pair of counter rotating vortices trailing from the wing tips. The vortices from large aircraft pose problems to encountering aircraft. For instance, the wake of these aircraft can impose rolling movements exceeding the roll control capability of some aircraft. Further, turbulence generated within the vortices can damage aircraft components and equipment if encountered at close range. The pilot must learn to envision the location of the vortex wake generated by large aircraft and adjust his flight path accordingly.

b. During ground operations and during takeoff, jet engine blast (thrust stream turbulence) can cause damage and upsets if encountered at close range. Exhaust velocity versus distance studies at various thrust levels have shown a need for light aircraft to maintain an adequate separation behind large turbojet aircraft. Below are examples of the distance requirements to avoid exhaust velocities of greater than 25 mph:

25 MPH VELOCITY	*B-727*	*DC-8*	*DC–10 / L–1011*	*B–747, B–767, B–757, A–300, and all re-engined B–707 / DC–8 aircraft*
Takeoff Thrust	550 Ft.	700 Ft.	2,100 Ft.	1,752 Ft.
Breakaway Thrust	200 Ft.	400Ft.	850 Ft.	1,250 Ft.
Idle Thrust	150 Ft.	100 Ft.	350 Ft.	620 Ft.

c. Operators of light aircraft can minimize their exposure to jet blast by:

(1) Holding well back of the runway edge or taxiway hold line to avoid the drifting turbulence;

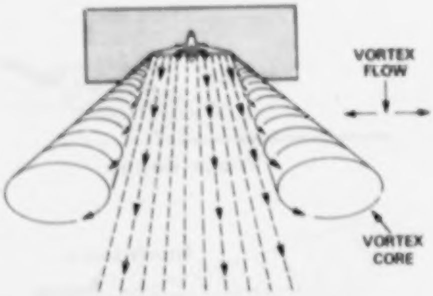
(2) Aligning the aircraft to face the possible jet blast; and

(3) Ensuring adequate separation when landing or taking off behind a departing large jet aircraft.

Pilots of large aircraft should be particularly careful to consider the effects of their jet blasts on other aircraft.

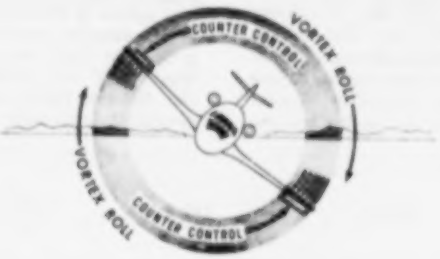
541. VORTEX GENERATION

Lift is generated by the creation of a pressure differential over the wing surface. The lowest pressure occurs over the upper wing surface and the highest pressure under the wing. This pressure differential triggers the roll up of the airflow aft of the wing resulting in swirling air masses trailing downstream of the wing tips. After the roll up is completed, the wake consists of two counter rotating cylindrical vortices.



542. VORTEX STRENGTH

a. The strength of the vortex is governed by the weight, speed, and shape of the wing of the generating aircraft. The vortex characteristics of any given aircraft can also be changed by extension of flaps or other wing configuring devices as well as by change in speed. However, as the basic factor is weight, the vortex strength increases proportionately. During tests, peak vortex tangential velocities were recorded at 224 feet per second, or about 133 knots. The greatest vortex strength occurs when the generating aircraft is HEAVY, CLEAN, and SLOW.



b. INDUCED ROLL

(1) In rare instances a wake encounter could cause in-flight structural damage of catastrophic proportions. However, the usual hazard is associated with induced rolling movements which can exceed the rolling capability of the encountering aircraft. In flight experiments, aircraft have been intentionally flown directly up trailing vortex cores of large aircraft. It was shown that the capability of an aircraft to counteract the roll imposed by the wake vortex primarily depends on the wing span and counter responsiveness of the encountering aircraft.

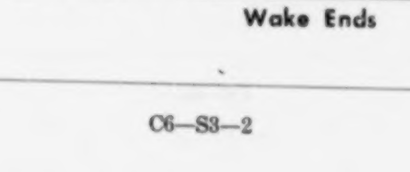
(2) Counter control is usually effective and induced roll minimal in cases where the wing span and ailerons of the encountering aircraft extend beyond the rotational flow field of the vortex. It is more difficult for aircraft with short wing span (relative to the generating aircraft) to counter the imposed roll induced by vortex flow. Pilots of short span aircraft, even of the high performance type, must be especially alert to vortex encounters.

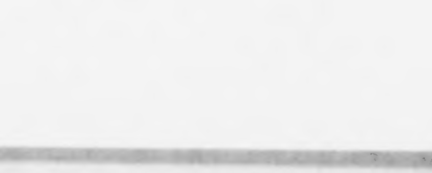
(3) The wake of large aircraft requires the respect of all pilots.

543. VORTEX BEHAVIOR

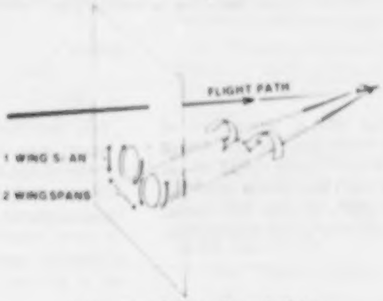
a. Trailing vortices have certain behavioral characteristics which can help a pilot visualize the wake location and thereby take avoidance precautions.

(1) Vortices are generated from the moment aircraft leave the ground, since trailing vortices are a by-product of wing lift. Prior to takeoff or touchdown pilots should note the rotation or touchdown point of the preceding aircraft.



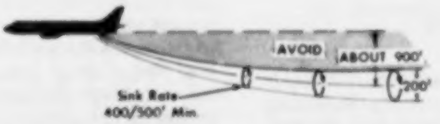


(2) The vortex circulation is outward, upward and around the wing tips when viewed from either ahead or behind the aircraft. Tests with large aircraft have shown that the vortex flow field, in a plane cutting through the wake at any point downstream, covers an area about 2 wing spans in width and one wing span in depth. The vortices remain so spaced (about a wing span apart) even drifting with the wind, at altitudes greater than a wing span from the ground. In view of this, if persistent vortex turbulence is encountered, a slight change of altitude and lateral position (preferably upwind) will provide a flight path clear of the turbulence.

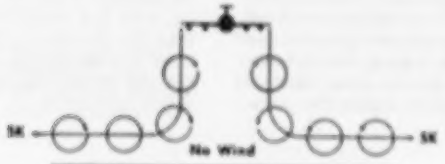


Vortex Flow Field in Aircraft Wake

(3) Flight tests have shown that the vortices from large aircraft sink at a rate of about 400 to 500 feet per minute. They tend to level off at a distance about 900 feet below the flight path of the generating aircraft. Vortex strength diminishes with time and distance behind the generating aircraft. Atmospheric turbulence hastens breakup. Pilots should fly at or above the large aircraft's flight path, altering course as necessary to avoid the area behind and below the generating aircraft.

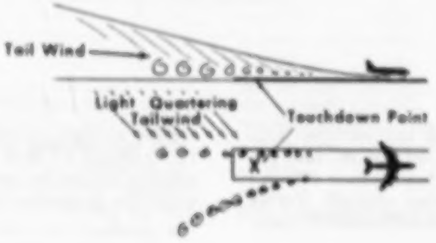


(4) When the vortices of large aircraft sink close to the ground (within about 200 feet), they tend to move laterally over the ground at a speed of about 5 knots.



Vortex Movement in Ground Effect - No Wind

b. A crosswind will decrease the lateral movement of the upwind vortex and increase the movement of the downwind vortex. Thus a light wind of 3 to 7 knots could result in the upwind vortex remaining in the touchdown zone for a period of time and hasten the drift of the downwind vortex toward another runway. Similarly, a tailwind condition can move the vortices of the preceding aircraft forward into the touchdown zone. THE LIGHT QUARTERING TAILWIND REQUIRES MAXIMUM CAUTION. Pilots should be alert to large aircraft upwind from their approach and takeoff flight paths.



544. OPERATIONS PROBLEM AREAS

a. A wake encounter is not necessarily hazardous. It can be one or more jolts with varying severity depending upon the direction of the encounter, distance from the generating aircraft, and point of vortex encounter. The probability of induced roll increases when the encountering aircraft's heading is generally aligned with the vortex trail or flight path of the generating aircraft.

b. AVOID THE AREA BELOW AND BEHIND THE GENERATING AIRCRAFT, ESPECIALLY AT LOW ALTITUDE WHERE EVEN A MOMENTARY WAKE ENCOUNTER COULD BE HAZARDOUS.

c. Pilots should be particularly alert in calm wind conditions and situations where the vortices could:

(1) Remain in the touchdown area.

(2) Drift from aircraft operating on a nearby runway.

(3) Sink into the takeoff or landing path from a crossing runway.

(4) Sink into the traffic patterns from other airport operations.

(5) Sink into the flight path of VFR flights operating at 500 feet AGL and below.

d. Pilots of all aircraft should visualize the location of the vortex trail behind large aircraft and use proper vortex avoidance procedures to achieve safe operation. It is equally important that pilots of large aircraft plan or adjust their flight paths to minimize vortex exposure to other aircraft.

545. VORTEX AVOIDANCE PROCEDURES

a. Under certain conditions, airport traffic controllers apply procedures for separating aircraft from heavy jet aircraft. The controllers will also provide VFR aircraft, with whom they are in communication and, which in the tower's opinion may be adversely affected by wake turbulence from a large aircraft, the position, altitude and direction of flight of the large aircraft followed by the phrase "CAUTION — WAKE TURBULENCE." WHETHER OR NOT A WARNING HAS BEEN GIVEN, HOWEVER, THE PILOT IS EXPECTED TO ADJUST HIS OPERATIONS AND FLIGHT PATH AS NECESSARY TO PRECLUDE SERIOUS WAKE ENCOUNTERS.

b. The following vortex avoidance procedures are recommended for the various situations:

(1) **Landing behind a large aircraft — same runway:** Stay at or above the large aircraft's final approach flight path — note his touchdown point — land beyond it.

(2) **Landing behind a large aircraft — when parallel runway is closer than 2,500 feet:** Consider possible drift to your runway. Stay at or above the large aircraft's final approach flight path — note his touchdown point.

(3) **Landing behind a large aircraft — crossing runway:** Cross above the large aircraft's flight path.

(4) **Landing behind a departing large aircraft — same runway:** Note the large aircraft's rotation point — land well prior to rotation point.

(5) **Landing behind a departing large aircraft — crossing runway:** Note the large aircraft's rotation point — if past the intersection — continue the approach — land prior to the intersection. If large aircraft rotates prior to the intersection, avoid flight below the large aircraft's flight path. Abandon the approach unless a landing is assured well before reaching the intersection.

(6) **Departing behind a large aircraft:** Note the large aircraft's rotation point — rotate prior to large aircraft's rotation point — continue climb above and stay upwind of the large aircraft's climb path until turning clear of his wake. Avoid subsequent headings which will cross below and behind a large aircraft. Be alert for any critical takeoff situation which could lead to a vortex encounter.

(7) **Intersection takeoffs — same runway:** Be alert to adjacent large aircraft operations particularly upwind of your runway. If intersection takeoff clearance is received, avoid subsequent heading which will cross below a large aircraft's path.

(8) **Departing or landing after a large aircraft executing a low approach, missed approach or touch-and-go landing:** Because vortices settle and move laterally near the ground, the vortex hazard may exist along the runway and in your flight path after a large aircraft has executed a low approach, missed approach or a touch-and-go landing, particular in light quartering wind conditions. You should assure that an interval of at least 2 minutes has elapsed before your takeoff or landing.

(9) **En route VFR (thousand-foot altitude plus 500 feet):** Avoid flight below and behind a large aircraft's path. If a large aircraft is observed above on the same track (meeting or overtaking) adjust your position laterally, preferably upwind.

546—549. RESERVED

550. HELICOPTERS

A hovering helicopter generates a downwash from its main rotor(s) similar to the prop blast of a conventional aircraft. However, in forward flight, this energy is transformed into a pair of trailing vortices similar to wing-tip vortices of fixed wing aircraft. Pilots of small aircraft should avoid the vortices as well as the downwash.

551. PILOT RESPONSIBILITY

a. Government and industry groups are making concerted efforts to minimize or eliminate the hazards of trailing vortices. However, the flight disciplines necessary to assure vortex avoidance during VFR operations must be exercised by the pilot. Vortex visualization and avoidance procedures should be exercised by the pilot using the same degree of concern as in collision avoidance.

b. Wake turbulence may be encountered by aircraft in flight as well as when operating on the airport movement area. (See WAKE TURBULENCE in the Pilot/Controller Glossary.)

c. Pilots are reminded that in operations conducted behind all aircraft, acceptance of instructions from ATC in the following situations is an acknowledgment that the pilot will ensure safe takeoff and landing intervals and accepts the responsibility of providing his own wake turbulence separation.

(1) Traffic information,

(2) Instructions to follow an aircraft, and

(3) The acceptance of a visual approach clearance.

d. For operations conducted behind heavy aircraft, ATC will specify the word "heavy" when this information is known. Pilots of heavy aircraft should always use the word "heavy" in radio communications.

552. AIR TRAFFIC WAKE TURBULENCE SEPARATIONS

a. Because of the possible effects of wake turbulence, controllers are required to apply no less than specified minimum separation for aircraft operating behind a heavy jet and, in certain instances, behind large nonheavy aircraft.

(1) Separation is applied to aircraft operating directly behind a heavy jet at the same altitude or less than 1,000 feet below:

(a) Heavy jet behind heavy jet — 4 miles.

(b) Small/large aircraft behind heavy jet — 5 miles.

(2) Also, separation, measured at the time the preceding aircraft is over the landing threshold, is provided to small aircraft:

(a) Small aircraft landing behind heavy jet — 6 miles.

(b) Small aircraft landing behind large aircraft - 4 miles.

NOTE.— See Aircraft Classes in Pilot/Controller Glossary.

(3) Additionally, appropriate time or distance intervals are provided to departing aircraft:

(a) Two minutes or the appropriate 4 or 5 mile radar separation when takeoff behind a heavy jet will be:

-from the same threshold

-on a crossing runway and projected flight paths will cross

-from the threshold of a parallel runway when staggered ahead of that of the adjacent runway by less than

500 feet and when the runways are separated by less than 2,500 feet.

NOTE.— Pilots, after considering possible wake turbulence effects, may specifically request waiver of the 2-minute interval by stating, "request waiver of 2-minute interval" or a similar statement. Controllers may acknowledge this statement as pilot acceptance of responsibility for wake turbulence separation and, if traffic permits, issue takeoff clearance.

b. A 3-minute interval will be provided when a small aircraft will takeoff:

(1) From an intersection on the same runway (same or opposite direction) behind a departing large aircraft,

(2) In the opposite direction on the same runway behind a large aircraft takeoff or low/missed approach.

NOTE.— This 3-minute interval may be waived upon specific pilot request.

c. A 3-minute interval will be provided for all aircraft taking off when the operations are as described in b(1) and (2) above, the preceding aircraft is a heavy jet, and the operations are on either the same runway or parallel runways separated by less than 2,500 feet. Controllers may not reduce or waive this interval.

d. Pilots may request additional separation i.e., 2 minutes instead of 4 or 5 miles for wake turbulence avoidance. This request should be made as soon as practical on ground control and at least before taxiing onto the runway.

NOTE.— FAR 91.3(a) states: "The pilot in command of an aircraft is directly responsible for and is the final authority as to the operation of that aircraft."

553—559. RESERVED

SECTION 4. BIRD HAZARDS, AND FLIGHT OVER NATIONAL REFUGES, PARKS, AND FORESTS

560. MIGRATORY BIRD ACTIVITY

a. Bird strike risk increases because of bird migration during the months of March through April, and August through November.

b. The altitudes of migrating birds vary with winds aloft, weather fronts, terrain elevations, cloud conditions, and other environmental variables. While over 90 percent of the reported bird strikes occur at or below 3,000 feet AGL, strikes at higher altitudes are common during migration. Ducks and geese are frequently observed up to 7,000 feet AGL and pilots are cautioned to minimize en route flying at lower altitudes during migration.

c. Considered the greatest potential hazard to aircraft because of their size, abundance, or habit of flying in dense flocks are gulls, waterfowl, vultures, hawks, owls, egrets, blackbirds, and starlings. Four major migratory flyways exist in the United States. The Atlantic flyway parallels the Atlantic Coast. The Mississippi Flyway stretches from Canada through the Great Lakes and follows the Mississippi River. The Central Flyway represents a broad area east of the Rockies, stretching from Canada through Central America. The Pacific Flyway follows the west coast and overflies major parts of Washington, Oregon, and California. There are also numerous smaller flyways which cross these major north-south migratory routes.

561. REDUCING BIRD STRIKE RISKS

a. The most serious strikes are those involving ingestion into an engine (turboprops and turbine jet engines) or windshield strikes. These strikes can result in emergency situations requiring prompt action by the pilot.

b. Engine ingestions may result in sudden loss of power or engine failure. Review engine out procedures, especially when operating from airports with known bird hazards or when operating near high bird concentrations.

c. Windshield strikes have resulted in pilots experiencing confusion, disorientation, loss of communications, and aircraft control problems. Pilots are encouraged to review their emergency procedures before flying in these areas.

d. When encountering birds en route, climb to avoid collision, because birds in flocks generally distribute themselves downward, with lead birds being at the highest altitude.

e. Avoid overflight of known areas of bird concentration and flying at low altitudes during bird migration. Charted wildlife refuges and other natural areas contain unusually high local concentration of birds which may create a hazard to aircraft.

562. REPORTING BIRD STRIKES

Pilots are urged to report strikes using FAA Form 5200-7, Bird Strike/Incident Report. This form is available at any FSS, General Aviation District Office, Air Carrier District Office, or at an FAA Regional Office. The data derived from these reports is used to develop standards to cope with this extensive hazard to aircraft and for documenation of necessary habitat control on airports.

563. REPORTING BIRD AND OTHER WILDLIFE ACTIVITIES

If you observe birds or other animals on or near the runway, request airport management to disperse the wildlife before taking off. Also contact the nearest FAA ARTCC, FSS, or tower (including non-Federal towers) regarding large flocks of birds and report the:

(1) Geographic location

(2) Bird type (geese, ducks, gulls, etc.)

(3) Approximate numbers

(4) Altitude

(5) Direction of bird flight path

564. PILOT ADVISORIES ON BIRD AND OTHER WILDLIFE HAZARDS

Many airports advise pilots of other wildlife hazards caused by large animals on the runway through the Airport/Facility Directory and the NOTAM system. Collisions of landing and departing aircraft and animals on the runway are increasing and are not limited to rural airports. These accidents have also occurred at several major airports. Pilots should exercise extreme caution when warned of the presence of wildlife on and in the vicinity of airports. If you observe deer or other large animals in close proximity to movement areas, advise the FSS, tower, or airport management.

565. FLIGHTS OVER CHARTED U.S. WILDLIFE REFUGES, PARKS, AND FOREST SERVICE AREAS

a. The landing of aircraft is prohibited on lands or waters administered by the National Park Service, U.S. Fish and Wildlife Service, or U.S. Forest Service without authorization from the respective agency. Exceptions, including

(1) when forced to land due to an emergency beyond the control of the operator,

(2) at officially designated landing sites, or

(3) an approved official business of the Federal Government.

b. All aircraft are requested to maintain a minimum altitude of 2,000 feet above the *surface* of the following: National Parks, Monuments, Seashores, Lakeshores, Recreation Areas and Scenic Riverways administered by the National Park Service, National Wildlife Refuges, Big Game Refuges, Game Ranges and Wildlife Ranges administered by the U.S. Fish and Wildlife Service, and Wilderness and Primitive areas administered by the U.S. Forest Service.

NOTE.— FAA Advisory Circular 91-36, Visual Flight Rules (VFR) Flight Near Noise-Sensitive Areas, defines the *surface* of a National Park Area (including Parks, Forests, Primitive Areas, Wilderness Areas, Recreational Areas, National Seashores, National Monuments, National Lakeshores, and National Wildlife Refuge and Range Areas) as: the highest terrain within 2,000 feet laterally of the route of flight, *or* the upper-most rim of a canyon or valley.

c. Federal regulations also prohibit airdrops by parachute or other means of persons, cargo, or objects from aircraft on lands administered by the three agencies without authorization from the respective agency. Exceptions include:

(1) emergencies involving the safety of human life, or

(2) threat of serious property loss.

566-569. RESERVED.

Section 5. POTENTIAL FLIGHT HAZARDS

570. ACCIDENT CAUSE FACTORS

a. The 10 most frequent cause factors for General Aviation Accidents that involve the pilot in command are:

(1) Inadequate preflight preparation and/or planning.
(2) Failure to obtain and/or maintain flying speed.
(3) Failure to maintain direction control.
(4) Improper level off.
(5) Failure to see and avoid objects or obstructions.
(6) Mismanagement of fuel.
(7) Improper in-flight decisions or planning.
(8) Misjudgment of distance and speed.
(9) Selection of unsuitable terrain.
(10) Improper operation of flight controls.

b. This list remains relatively stable and points out the need for continued refresher training to establish a higher level of flight proficiency for all pilots. A part of the FAA's continuing effort to promote increased aviation safety is the General Aviation Accident Prevention Program. For information on Accident Prevention activities contact your nearest General Aviation or Flight Standards District Office.

c. ALERTNESS — Be alert at all times, especially when the weather is good. Most pilots pay attention to business when they are operating in full IFR weather conditions, but strangely, air collisions almost invariably have occurred under ideal weather conditions. Unlimited visibility appears to encourage a sense of security which is not at all justified. Considerable information of value may be obtained by listening to advisories being issued in the terminal area, even though controller workload may prevent a pilot from obtaining individual service.

d. GIVING WAY — If you think another aircraft is too close to you, give way instead of waiting for the other pilot to respect the right-of-way to which you may be entitled. It is a lot safer to pursue the right-of-way angle after you have completed your flight.

571. VFR IN CONGESTED AREAS

A high percentage of near midair collisions occur below 8,000 feet AGL and within 30 miles of an airport. When operating VFR in these highly congested areas, whether you intend to land at an airport within the area or are just flying through, it is recommended that extra vigilance be maintained and that you monitor an appropriate control frequency. Normally the appropriate frequency is an approach control frequency. By such monitoring action you can "get the picture" of the traffic in your area. When the approach controller has radar, radar traffic advisories may be given to VFR pilots upon request. (See PARA—162 - RADAR TRAFFIC INFORMATION SERVICE.)

572. OBSTRUCTIONS TO FLIGHT

a. Antenna Towers

Extreme caution should be exercised when flying less than 2,100 feet above ground level (AGL) because of the numerous skeletal structures (radio and television antenna towers) exceeding 1,000 feet AGL with some extending higher than 2,000 feet AGL. Most skeletal structures are supported by guy wires. The wires are difficult to see in good weather and can be totally obscured during periods of dusk and reduced visibility. These wires can extend about 1,500 feet horizontally from a structure; therefore, all skeletal structures should be avoided by at least 2,000 feet.

b. Overhead Wires

Overhead transmission and utility lines often span approaches to runways and scenic flyways such as lakes, rivers, and canyons. The supporting structures of these lines may not always be readily visible and the wires may be virtually invisible under certain conditions. Most of these installations do not meet criteria which determine them to be obstructions to air navigation and therefore do not require marking and/or lighting. The supporting structures of some overhead transmission lines are equipped with flashing strobe lights. These lights indicate wires exist between the strobed structures.

573. AVOID FLIGHT BENEATH UNMANNED BALLOONS

a. The majority of unmanned free balloons currently being operated have, extending below them, either a suspension device to which the payload or instrument package is attached, or a trailing wire antenna, or both. In many instances these balloon subsystems may be invisible to the pilot until his aircraft is close to the balloon, thereby creating a potentially dangerous situation. Therefore, good judgment on the part of the pilot dictates that aircraft should remain well clear of all unmanned free balloons and flight below them should be avoided at all times.

b. Pilots are urged to report any unmanned free balloons sighted to the nearest FAA ground facility with which communication is established. Such information will assist FAA ATC facilities to identify and flight follow unmanned free balloons operating in the airspace.

574. MOUNTAIN FLYING

a. Your first experience of flying over mountainous terrain (particularly if most of your flight time has been over the flatlands of the midwest) could be a never-to-be-forgotten nightmare if proper planning is not done and if you are not aware of the potential hazards awaiting. Those familiar section lines are not present in the mountains; those flat, level fields for forced landings are practically nonexistent; abrupt changes in wind direction and velocity occur; severe updrafts and downdrafts are common, particularly near or

above abrupt changes of terrain such as cliffs or rugged areas; even the clouds look different and can build up with startling rapidity. Mountain flying need not be hazardous if you follow the recommendations below:

b. File a flight plan. Plan your route to avoid topography which would prevent a safe forced landing. The route should be over populated areas and well known mountain passes. Sufficient altitude should be maintained to permit gliding to a safe landing in the event of engine failure.

c. Don't fly a light aircraft when the winds aloft, at your proposed altitude, exceed 35 miles per hour. Expect the winds to be of much greater velocity over mountain passes than reported a few miles from them. Approach mountain passes with as much altitude as possible. Downdrafts of from 1,500 to 2,000 feet per minute are not uncommon on the leeward side.

d. Don't fly near or above abrupt changes in terrain. Severe turbulence can be expected, especially in high wind conditions.

e. Some canyons run into a dead end. Don't fly so far up a canyon that you get trapped. ALWAYS BE ABLE TO MAKE A 180 DEGREE TURN!

f. Plan your trip for the early morning hours. As a rule, the air starts to get bad at about 10 a.m., and grows steadily worse until around 4 p.m., then gradually improves until dark. Mountain flying at night in a single engine light aircraft is asking for trouble.

g. When landing at a high altitude field, the same indicated airspeed should be used as at low elevation fields. *Remember:* that due to the less dense air at altitude, this same indicated airspeed actually results in higher true airspeed, a faster landing speed, and more important, a longer landing distance. During gusty wind conditions which often prevail at high altitude fields, a power approach and power landing is recommended. Additionally, due to the faster groundspeed, your takeoff distance will increase considerably over that required at low altitudes.

h. Effects of Density Altitude. Performance figures in the aircraft owner's handbook for length of takeoff run, horsepower, rate of climb, etc., are generally based on standard atmosphere conditions (59 degrees Fahrenheit (15 degrees Celsius), pressure 29.92 inches of mercury)at sea level. However, inexperienced pilots, as well as experienced pilots, may run into trouble when they encounter an altogether different set of conditions. This is particularly true in hot weather and at higher elevations. Aircraft operations at altitudes above sea level and at higher than standard temperatures are commonplace in mountainous areas. Such operations quite often result in a drastic reduction of aircraft performance capabilities because of the changing air density. Density altitude is a measure of air density. It is not to be confused with pressure altitude, true altitude or absolute altitude. It is not to be used as a height reference, but as a determining criteria in the performance capability of an aircraft. Air density decreases with altitude. As air density decreases, density altitude increases. The further effects of high temperature and high humidity are cumulative, resulting in an increasing high density altitude condition. High density altitude reduces all aircraft performance parameters. To the pilot, this means that the normal horsepower output is reduced, propeller efficiency is reduced and a higher true airspeed is required to sustain the aircraft throughout its operating parameters. It means an increase in runway length requirements for takeoff and landings, and decreased rate of climb. An average small airplane, for example, requiring 1,000 feet for takeoff at sea level under standard atmospheric conditions will require a takeoff run of approximately 2,000 feet at an operational altitude of 5,000 feet.

NOTE.— A turbo-charged aircraft engine provides some slight advantage in that it provides sea level horsepower up to a specified altitude above sea level.

(1) Density Altitude Advisories — at airports with elevations of 2,000 feet and higher, control towers and FSSs will broadcast the advisory "Check Density Altitude" when the temperature reaches a predetermined level. These advisories will be broadcast on appropriate tower frequencies or, where available, ATIS. FSSs will broadcast these advisories as a part of Airport Advisory Service, and on TWEB.

(2) These advisories are provided by air traffic facilities, as a reminder to pilots that high temperatures and high field elevations will cause significant changes in aircraft characteristics. The pilot retains the responsibility to compute density altitude, when appropriate, as a part of preflight duties.

NOTE.— All FSSs will compute the current density altitude upon request.

i. Mountain Wave. Many pilots go all their lives without understanding what a mountain wave is. Quite a few have lost their lives because of this lack of understanding. One need not be a licensed meteorologist to understand the mountain wave phenomenon.

(1) Mountain waves occur when air is being blown over a mountain range or even the ridge of a sharp bluff area. As the air hits the upwind side of the range, it starts to climb, thus creating what is generally a smooth updraft which turns into a turbulent downdraft as the air passes the crest of the ridge. From this point, for many miles downwind, there will be a series of downdrafts and updrafts. Satellite photos of the Rockies have shown mountain waves extending as far as 700 miles downwind of the range. Along the east coast area, such photos of the Appalachian chain have picked up the moutain wave phenomenon over a hundred miles eastward. All it takes to form a mountain wave is wind blowing across the range at 15 knots or better at an intersection angle of not less than 30 degrees.

(2) Pilots from flatland areas should understand a few things about mountain waves in order to stay out of trouble. When approaching a mountain range from the upwind side (generally the west), there will usually be a smooth updraft; therefore, it is not quite as dangerous an area as the lee of the range. From the leeward side, it is always a good idea to add an extra thousand feet or so of altitude because downdrafts can exceed the climb capability of the aircraft. Never expect an updraft when approaching a mountain chain from the leeward. Always be prepared to cope with a downdraft and turbulence.

(3) When approaching a mountain ridge from the downwind side, it is recommended that the ridge be approached at approximately a 45 degrees angle to the horizontal direction of the ridge. This permits a safer retreat from the ridge with less stress on the aircraft should severe turbulence and downdraft be experienced. If severe turbulence is encountered, simultaneously reduce power and adjust pitch until aircraft approaches maneuvering speed,

then adjust power and trim to maintain maneuvering speed and fly away from the turbulent area.

575—579. RESERVED

NOTES

Section 6. SAFETY, ACCIDENT AND HAZARD REPORTS

580. AVIATION SAFETY REPORTING PROGRAM

a. The FAA has established a voluntary Aviation Safety Reporting Program designed to stimulate the free and unrestricted flow of information concerning deficiencies and discrepancies in the aviation system. This is a positive program intended to ensure the safest possible system by identifying and correcting unsafe conditions before they lead to accidents. The primary objective of the program is to obtain information to evaluate and enhance the safety and efficiency of the present system.

b. This program applies primarily to that part of the system involving the safety of aircraft operations, including departure, en route, approach and landing operations and procedures, ATC procedures, pilot/controller communications, the aircraft movement area of the airport, and near midair collisions. Pilots, air traffic controllers, and all other members of the aviation community and the general public are asked to file written reports of any discrepancy or deficiency noted in these areas.

c. The report should give the date, time, location, persons and aircraft involved (if applicable), nature of the event, and all pertinent details.

d. To ensure receipt of this information, the program provides for the waiver of certain disciplinary actions against persons, including pilots and air traffic controllers, who file timely written reports concerning potentially unsafe incidents. To be considered timely, reports must be delivered or postmarked within 10 days of the incident unless that period is extended for good cause. Reporting forms are available at FAA facilities.

e.The FAA utilizes the National Aeronautics and Space Administration (NASA) to act as an independent third party to receive and analyze reports submitted under the program. This program is described in ADVISORY CIRCULAR—00-46.

581. AIRCRAFT ACCIDENT AND INCIDENT REPORTING

a. OCCURRENCES REQUIRING NOTIFICATION — The operator of an aircraft shall immediately, and by the most expeditious means available, notify the nearest National Transportation Safety Board (NTSB) Field Office when:

(1) An aircraft accident or any of the following listed incidents occur:

(a) Flight control system malfunction or failure;

(b) Inability of any required flight crew member to perform his normal flight duties as a result of injury or illness;

(c) Failure of structural components of a turbine engine excluding compressor and turbine blades and vanes.

(d) In-flight fire;

(e) Aircraft collide in flight.

(2) An aircraft is overdue and is believed to have been involved in an accident.

b. MANNER OF NOTIFICATION:

(1) The most expeditious method of notification to the NTSB by the operator will be determined by the circumstances existing at that time. The NTSB has advised that any of the following would be considered examples of the type of notification that would be acceptable:

(a) Direct telephone notification.

(b) Telegraphic notification.

(c) Notification to the FAA who would in turn notify the NTSB by direct communication; i.e., dispatch or telephone.

c. ITEMS TO BE NOTIFIED — The notification required above shall contain the following information, if available:

(1) Type, nationality, and registration marks of the aircraft;

(2) Name of owner and operator of the aircraft;

(3) Name of the pilot-in-command;

(4) Date and time of the accident, or incident;

(5) Last point of departure and point of intended landing of the aircraft;

(6) Position of the aircraft with reference to some easily defined geographical point;

(7) Number of persons aboard, number killed, and number seriously injured;

(8) Nature of the accident, or incident, the weatheer, and the extent of damage to the aircraft, so far as is known; and

(9) A description of any explosives, radioactive materials, or other dangerous articles carried.

d. FOLLOW UP REPORTS:

(1) The operator shall file a report on NTSB Form 6120.1 or 6120.2, available from NTSB Field Offices, or from the NTSB, Washington, D.C., 20594.

(a) Within 10 days after an accident;

(b) When, after 7 days, an overdue aircraft is still missing;

(c) A report on an incident for which notification is required as described in subparagraph a(1) shall be filed only as requested by an authorized representative of the NTSB.

(2) Each crewmember, if physically able at the time the report is submitted, shall attach a statement setting forth the facts, conditions and circumstances relating to the accident or incident as they appear to him. If the crewmember is incapacitated, he shall submit the statement as soon as he is physically able.

e. WHERE TO FILE THE REPORTS

(1) The operator of an aircraft shall file with the NTSB Field Office nearest the accident or incident any report required by this section.

(2) The NTSB Field Offices are listed under U.S. Government in the telephone directories in the following cities: Anchorage, AK; Atlanta, GA; Chicago, IL; Denver, CO; Forth Worth, TX; Kansas City, MO; Los Angeles, CA; Miami, FL; New York, NY; Seattle, WA.

582. NEAR MIDAIR COLLISION REPORTING

a. PURPOSE AND DATA USES — The primary purpose of the Near Midair Collision (NMAC) Reporting Program is to provide information for use in enhancing the safety and efficiency of the National Airspace System. Data obtained from NMAC reports are used by the FAA to improve the quality of FAA services to users and to develop programs, policies, and procedures aimed at the reduction of NMAC occurrences. All NMAC reports are thoroughly investigated by Flight Standards Facilities in coordination with Air Traffic Facilities. Data from these investigations are transmitted to FAA Headquarters in Washington, D.C. where they are compiled and analyzed, and where safety programs and recommendations are developed.

b. DEFINITION — A near midair collision is defined as an incident associated with the operation of an aircraft in which a possibility of collision occurs as a result of proximity of less than 500 feet to another aircraft, or a report is received from a pilot or a flight crew member stating that a collision hazard existed between two or more aircraft.

c. REPORTING RESPONSIBILITY — It is the responsibility of the pilot and/or flight crew to determine whether a near midair collision did actually occur and, if so, to initiate a NMAC report. Be specific, as ATC will not interpret a casual remark to mean that a NMAC is being reported.

d. WHERE TO FILE REPORTS — Pilots and/or flight crew members involved in NMAC occurrences are urged to report each incident immediately:

(1) By radio or telephone to the nearest FAA ATC facility or FSS.

(2) In writing, in lieu of the above, to the nearest Air Carrier District Office (ACDO), General Aviation District Office (GADO), or Flight Standards District Office (FSDO).

e. ITEMS TO BE REPORTED —

(1) Date and Time (UTC) of incident.

(2) Location of incident and altitude.

(3) Identification and type of reporting aircraft, aircrew destination, name and home base of pilot.

(4) Identification and type of other aircraft, aircrew destination, name and home base of pilot.

(5) Type of flight plans; station altimeter setting used.

(6) Detailed weather conditions at altitude or flight level.

(7) Approximate courses of both aircraft: indicate if one or both aircraft were climbing or descending.

(8) Reported separation in distance at first sighting, proximity at closest point horizontally and vertically, length of time in sight prior to evasive action.

(9) Degree of evasive action taken, if any (from both aircraft, if possible).

(10) Injuries, if any.

f. INVESTIGATION — The district office responsible for the investigation and reporting of NMAC's will be:

(1) The Air Carrier or Flight Standards District Office in whose area the incident occurred when an air carrier aircraft is involved.

(2) The General Aviation or Flight Standards District Office in whose area the incident occurred in all other cases.

Existing radar, communication, and weather data will be examined in the conduct of the investigation. When possible, all cockpit crew members will be interviewed regarding factors involving the NMAC incident. Air Traffic controllers will be interviewed in cases where one or more of the involved aircraft was provided ATC service. Both flight and ATC procedures will be evaluated. When the investigation reveals a violation of an FAA regulation, enforcement action will be pursued.

583—599. RESERVED

Chapter 7. MEDICAL FACTS FOR PILOTS

Section 1. FITNESS FOR FLIGHT

600. FITNESS FOR FLIGHT

a. Medical Certification

(1) All pilots except those flying gliders and free air ballons must possess valid medical certificates in order to exercise the privileges of their airman certificates. The periodic medical examinations required for medical certification are conducted by designated Aviation Medical Examiners, who are physicians with a special interest in aviation safety and training in aviation medicine.

(2) The standards for medical certification are contained in FAR—67. Pilots who have a history of certain medical conditions described in these standards are mandatorily disqualified from flying. These medical conditions include a personality disorder manifested by overt acts, a psychosis, alcoholism, drug dependence, epilepsy, an unexplained disturbance of consciousness, myocardial infarction, angina pectoris and diabetes requiring medication for its control. Other medical conditions may be temporarily disqualifying, such as acute infections, anemia, and peptic ulcer. Pilots who do not meet medical standards may still be qualified under special issuance provisions or the exemption process. This may require that either additional medical information be provided or practical flight tests be conducted.

(3) Student pilots should visit an Aviation Medical Examiner as soon as possible in their flight training in order to avoid unnecessary training expenses should they not meet the medical standards. For the same reason, the student pilot who plans to enter commercial aviation should apply for the highest class of medical certificate that might be necessary in the pilot's career.

Caution: The FARs prohibit a pilot who possesses a current medical certificate from performing crewmember duties while the pilot has a known medical condition or increase of a known medical condition that would make the pilot unable to meet the standards for the medical certificate.

b. Illness

(1) Even a minor illness suffered in day-to-day living can seriously degrade performance of many piloting tasks vital to safe flight. Illness can produce fever and distracting symptoms that can impair judgment, memory, alertness, and the ability to make calculations. Although symptoms from an illness may be under adequate control with a medication, the medication itself may decrease pilot performance.

(2) The safest rule is not to fly while suffering from any illness. If this rule is considered too stringent for a particular illness, the pilot should contact an Aviation Medical Examiner for advice.

c. Medication

(1) Pilot performance can be seriously degraded by both prescribed and over-the-counter medications, as well as by the medical conditions for which they are taken. Many medications, such as tranquilizers, sedatives, strong pain relievers, and cough-suppressant preparations, have primary effects that may impair judgment, memory, alertness, coordination, vision, and the ability to make calculations. Others, such as antihistamines, blood pressure drugs, muscle relaxants, and agents to control diarrhea and motion sickness, have side effects that may impair the same critical functions. Any medication that depresses the nervous system, such as a sedative, tranquilizer or antihistamine, can make a pilot much more susceptible to hypoxia.

(2) The FARs prohibit pilots from performing crewmember duties while using any medication that affects the faculties in any way contrary to safety. The safest rule is not to fly as a crewmember while taking any medication, unless approved to do so by the FAA.

d. Alcohol

(1) Extensive research has provided a number of facts about the hazards of alcohol consumption and flying. As little as one ounce of liquor, one bottle of beer or four ounces of wine can impair flying skills, with the alcohol consumed in these drinks being detectable in the breath and blood for at least 3 hours. Even after the body completely destroys a moderate amount of alcohol, a pilot can still be severely impaired for many hours by hangover. There is simply no way of increasing the destruction of alcohol or alleviating a hangover. Alcohol also renders a pilot much more susceptible to disorientation and hypoxia.

(2) A consistently high alcohol related fatal aircraft accident rate serves to emphasize that alcohol and flying are a potentially lethal combination. The FARs prohibit pilots from performing crewmember duties within 8 hours after drinking any alcoholic beverage or while under the influence of alcohol. However, due to the slow destruction of alcohol, a pilot may still be under influence 8 hours after drinking a moderate amount of alcohol. Therefore, an excellent rule is to allow at least 12 to 24 hours between "bottle and throttle," depending on the amount of alcoholic beverage consumed.

e. Fatigue

(1) Fatigue continues to be one of the most treacherous hazards to flight safety, as it may not be apparent to a pilot until serious errors are made. Fatigue is best described as either acute (short-term) or chronic (long-term).

(2) A normal occurrence of everyday living, acute fatigue is the tiredness felt after long periods of physical and mental strain, including strenuous muscular effort, immobility, heavy mental workload, strong emotional pressure, monotony and lack of sleep. Consequently, coordination and alertness, so vital to safe pilot performance, can be reduced. Acute fatigue is prevented by adequate rest and sleep, as well as regular exercise and proper nutrition.

(3) Chronic fatigue occurs when there is not enough time for full recovery between episodes of acute fatigue. Performance continues to fall off, and judgment becomes impaired so that unwarranted risks may be taken. Recovery from chronic fatigue requires a prolonged period of rest.

f. Stress

(1) Stress from the pressures of everyday living can impair pilot performance, often in very subtle ways. Difficulties, particularly at work, can occupy thought processes enough to markedly decrease alertness. Distraction can so interfere with judgment that unwarranted risks are taken, such as flying into deteriorating weather conditions to keep on schedule. Stress and fatigue (see above) can be an extremely hazardous combination.

(2) Most pilots do not leave stress "on the ground." Therefore, when more than usual difficulties are being experienced, a pilot should consider delaying flight until these difficulties are satisfactorily resolved.

g. Emotion

(1) Certain emotionally upsetting events, including a serious argument, death of a family member, separation or divorce, loss of job and financial catastrophe, can render a pilot unable to fly an aircraft safely. The emotions of anger, depression, and anxiety from such events not only decrease alertness but also may lead to taking risks that border on self-destruction. Any pilot who experiences an emotionally upsetting event should not fly until satisfactorily recovered from it.

h. Personal Checklist

(1) Aircraft accident statistics show that pilots should be conducting preflight checklists on themselves as well as their aircraft, for pilot impairment contributes to many more accidents than failures of aircraft systems. A personal checklist that can be easily committed to memory, which includes all of the categories of pilot impairment as discussed in this section, is being distributed by the FAA in the form of a wallet-sized card.

PERSONAL CHECKLIST

I'm physically and mentally safe to fly — not being impaired by:

I llness,
M edication,
S tress,
A lcohol,
F atigue,
E motion.

601. EFFECTS OF ALTITUDE

a. Hypoxia

(1) Hypoxia is a state of oxygen deficiency in the body sufficient to impair functions of the brain and other organs. Hypoxia from exposure to altitude is due only to the reduced barometric pressures encountered at altitude, for the concentration of oxygen in the atmosphere remains about 21 percent from the ground out to space.

(2) Although a deterioration in night vision occurs at a cabin pressure altitude as low as 5,000 feet, other significant effects of altitude hypoxia usually do not occur in the normal healthy pilot below 12,000 feet. From 12,000 to 15,000 feet of altitude, judgment, memory, alertness, coordination and ability to make calculations are impaired, and headache, drowsiness, dizziness and either a sense of well-being (euphoria) or belligerence occur. The effects appear following increasingly shorter periods of exposure to increasing altitude. In fact, pilot performance can seriously deteriorate within 15 minutes at 15,000 feet.

(3) At cabin pressure altitudes above 15,000 feet, the periphery of the visual field grays out to a point where only central vision remains (tunnel vision). A blue coloration (cyanosis) of the fingernails and lips develops. The ability to take corrective and protective action is lost in 20 to 30 minutes at 18,000 feet and 5 to 12 minutes at 20,000 feet, followed soon thereafter by unconsciousness.

(4) The altitude at which significant effects of hypoxia occur can be lowered by a number of factors. Carbon monoxide inhaled in smoking or from exhaust fumes, lowered hemoglobin (anemia), and certain medications can reduce the oxygen-carrying capacity of the blood to the degree that the amount of oxygen provided to body tissues will already be equivalent to the oxygen provided to the tissues when exposed to a cabin pressure altitude of several thousand feet. Small amounts of alcohol and low doses of certain drugs, such as antihistamines, tranquilizers, sedatives and analgesics can, through their depressant action, render the brain much more susceptible to hypoxia. Extreme heat and cold fever, and anxiety increase the body's demand for oxygen, and hence its susceptibility to hypoxia.

(5) The effects of hypoxia are usually quite difficult to recognize, especially when they occur gradually. Since symptoms of hypoxia do not vary in an individual, the ability to recognize hypoxia can be greatly improved by experiencing and witnessing the effects of hypoxia during an altitude chamber "flight." The FAA provides this opportunity through aviation physiology training, which is conducted at the FAA Civil Aeromedical Institute and at many military facilities across the United States. Pilots can apply for this training by contacting the Physiological Operations and Training Section, AAC-143, FAA Civil Aeromedical Institute, P.O. Box 25082, Oklahoma City, Oklahoma 73125.

(6) Hypoxia is prevented by heeding factors that reduce tolerance to altitude, by enriching the inspired air with oxygen from an appropriate oxygen system and by maintaining a comfortable, safe cabin pressure altitude. For optimum protection, pilots are encouraged to use supplemental oxygen above 10,000 feet during the day, and above 5,000 feet at night. The FARs require that the minimum flight crew be provided with and use supplemental oxygen after 30 minutes of exposure to cabin pressure altitudes between 12,500 and 14,000 feet, and immediately on exposure to cabin pressure altitudes above 14,000 feet. Every occupant of the aircraft must be provided with supplemental oxygen at cabin pressure altitudes above 15,000 feet.

b. Ear Block

(1) As the aircraft cabin pressure decreases during ascent, the expanding air in the middle ear pushes the eustachian tube open and, by escaping down it to the nasal passages, equalizes in pressure with the cabin pressure. But during descent, the pilot must periodically open the eustachian tube to equalize pressure. This can be accomplished by swallowing, yawning, tensing muscles in the throat or, if these do not work, by the combination of clos-

ing the mouth, pinching the nose closed and attempting to blow through the nostrils (Valsalva maneuver).

(2) Either an upper respiratory infection, such as a cold or sore throat, or a nasal allergic condition can produce enough congestion around the eustachian tube to make equalization difficult. Consequently, the difference in pressure between the middle ear and aircraft cabin can build up to a level that will hold the eustachian tube closed, making equalization difficult if not impossible. The problem is commonly referred to as an "ear block."

(3) An ear block produces severe ear pain and loss of hearing that can last from several hours to several days. Rupture of the ear drum can occur in flight or after landing. Fluid can accumulate in the middle ear and become infected.

(4) An ear block is prevented by not flying with an upper respiratory infection or nasal allergic condition. Adequate protection is usually not provided by decongestant sprays or drops to reduce congestion around the eustachian tubes. Oral decongestants have side effects that can significantly impair pilot performance.

(5) If an ear block does not clear shortly after landing, a physician should be consulted.

c. Sinus Block

(1) During ascent and descent, air pressure in the sinuses equalizes with the aircraft cabin pressure through small openings that connect the sinuses to the nasal passages. Either an upper respiratory infection, such as a cold or sinusitis, or a nasal allergic condition can produce enough congestion around an opening to slow equalization and, as the difference in pressure between the sinus and cabin mounts, eventually plug the opening. This "sinus block" occurs most frequently during descent.

(2) A sinus block can occur in the frontal sinuses, located above each eyebrow, or in the maxillary sinuses, located in each upper cheek. It will usually produce excruciating pain over the sinus area. A maxillary sinus block can also make the upper teeth ache. Bloody muscus may discharge from the nasal passages.

(3) A sinus block is prevented by not flying with an upper respiratory infection or nasal allergic condition. Adequate protection is usually not provided by decongestant sprays or drops to reduce congestion around the sinus openings. Oral decongestants have side effects that can impair pilot performance.

(4) If a sinus block does not clear shortly after landing, a physician should be consulted.

d. Decompression Sickness After Scuba Diving

(1) A pilot or passenger who intends to fly after scuba diving should allow the body sufficient time to rid itself of excess nitrogen absorbed during diving. If not, decompression sickness due to evolved gas can occur during exposure to low altitude and create a serious in-flight emergency.

(2) The recommended waiting time before flight to cabin pressure altitudes of 8,000 feet or less is at least 4 hours after diving which has not required controlled ascent (nondecompression diving), and at least 24 hours after diving which has required controlled ascent (decompression diving). The waiting time before flight to cabin pressure altitudes above 8,000 feet should be at least 24 hours after any scuba diving.

602. HYPERVENTILATION IN FLIGHT

a. Hyperventilation, or an abnormal increase in the volume of air breathed in and out of the lungs, can occur subconsciously when a stressful situation is encountered in flight. As hyperventilation "blows off" excessive carbon dioxide from the body, a pilot can experience symptoms of lightheadedness, suffocation, drowsiness, tingling in the extremities, and coolness—and react to them with even greater hyperventilation. Incapacitation can eventually result from incoordination, disorientation, and painful muscle spasms. Finally, unconsciousness can occur.

b. The symptoms of hyperventilation subside within a few minutes after the rate and depth of breathing are consciously brought back under control. The buildup of carbon dioxide in the body can be hastened by controlled breathing in and out of a paper bag held over the nose and mouth.

c. Early symptoms of hyperventilation and hypoxia are similar. Moreover, hyperventilation and hypoxia can occur at the same time. Therefore, if a pilot is using an oxygen system when symptoms are experienced, the oxygen regulator should immediately be set to deliver 100 percent oxygen, and then the system checked to assure that it has been functioning effectively before giving attention to rate and depth of breathing.

603. CARBON MONOXIDE POISONING IN FLIGHT

a. Carbon monoxide is a colorless, odorless and tasteless gas contained in exhaust fumes. When breathed even in minute quantities over a period of time, it can significantly reduce the ability of the blood to carry oxygen. Consequently, effects of hypoxia occur.

b. Most heaters in light aircraft work by air flowing over the manifold. Use of these heaters while exhaust fumes are escaping through manifold cracks and seals is responsible every year for several nonfatal and fatal aircraft accidents from carbon monoxide poisoning.

c. A pilot who detects the odor of exhaust or experiences symptoms of headache, drowsiness, or dizziness while using the heater should suspect carbon monoxide poisoning, and immediately shut off the heater and open air vents. If symptoms are severe, or continue after landing, medical treatment should be sought.

604. ILLUSIONS IN FLIGHT

a. Introduction

(1) Many different illusions can be experienced in flight. Some can lead to spatial disorientation. Others can lead to landing errors. Illusions rank among the most common factors cited as contributing to fatal aircraft accidents.

b. Illusions Leading to Spatial Disorientation

(1) Various complex motions and forces and certain visual scenes encountered in flight can create illusions of motion and position. Spatial disorientation from these illusions can be prevented only by visual reference to reliable, fixed points on the ground or to flight instruments.

(2) The leans — An abrupt correction of a banked attitude, which has been entered too slowly to stimulate the motion sensing system in the inner ear, can create the illusion of banking in the opposite direction. The disoriented pilot will roll the aircraft back into its original dangerous attitude or, if level flight is maintained, will feel compelled to lean in the perceived vertical plane until this illusion subsides.

(a) Coriolis illusion — An abrupt head movement in a prolonged constant-rate turn that has ceased stimulating the motion sensing system can create the illusion of rotation or movement in an entirely different axis. The disoriented pilot will maneuver the aircraft into a dangerous attitude in an attempt to stop rotation. This most overwhelming of all illusions in flight may be prevented by not making sudden, extreme head movements, particularly while making prolonged constant-rate turns under IFR conditions.

(b) Graveyard spin — A proper recovery from a spin that has ceased stimulating the motion sensing system can create the illusion of spinning in the opposite direction. The disoriented pilot will return the aircraft to its original spin.

(c) Graveyard spiral— An observed loss of altitude during a coordinated constant-rate turn that has ceased stimulating the motion sensing system can create the illusion of being in a descent with the wings level. The disoriented pilot will pull back on the controls, tightening the spiral and increasing the loss of altitude.

(d) Somatogravic illusion — A rapid acceleration during takeoff can create the illusion of being in a nose up attitude. The disoriented pilot will push the aircraft into a nose low, or dive attitude. A rapid deceleration by a quick reduction of the throttles can have the opposite effect, with the disoriented pilot pulling the aircraft into a nose up, or stall attitude.

(e) Inversion illusion — An abrupt change from climb to straight and level flight can create the illusion of tumbling backwards. The disoriented pilot will push the aircraft abruptly into a nose low attitude, possibly intensifying this illusion.

(f) Elevator illusion — An abrupt upward vertical acceleration, usually by an updraft, can create the illusion of being in a climb. The disoriented pilot will push the aircraft into a nose low attitude. An abrupt downward vertical acceleration, usually by a downdraft, has the opposite effect, with the disoriented pilot pulling the aircraft into a nose up attitude.

(g) False horizon — Sloping cloud formations, an obscured horizon, a dark scene spread with ground lights and stars, and certain geometric patterns of ground light can create illusions of not being aligned correctly wih the actual horizon. The disoriented pilot will place the aircraft in a dangerous attitude.

(h) Autokinesis — In the dark, a static light will appear to move about when stared at for many seconds. The disoriented pilot will lose control of the aircraft in attempting to align it with the light.

(3) Illusions Leading to Landing Errors

(a) Various surface features and atmospheric conditions encountered in landing can create illusions of incorrect height above and distance from the runway threshold. Landing errors from these illusions can be prevented by anticipating them during approaches, aerial visual inspection of unfamiliar airports before landing, using electronic glide slope or VASI systems when available, and maintaining optimum proficiency in landing procedures.

(b) Runway width illusion — a narrower-than-usual runway can create the illusion that the aircraft is at a higher altitude than it actually is. The pilot who does not recognize this illusion will fly a lower approach, with the risk of striking objects along the approach path or landing short. A wider-than-usual runway can have the opposite effect, with the risk of leveling out high and landing hard or overshooting the runway.

(c) Runway and terrain slopes illusion — An upsloping runway, upsloping terrain, or both, can create the illusion that the aircraft is at a higher altitude than it actually is. The pilot who does not recognize this illusion will fly a lower approach. A downsloping runway, downsloping approach terrain, or both, can have the opposite effect.

(d) Featureless terrain illusion — An absence of ground features, as when landing over water, darkened areas and terrain made featureless by snow, can create the illusion that the aircraft is at a higher altitude than it actually is. The pilot who does not recognize this illusion will fly a lower approach.

(e) Atmospheric illusions — Rain on the windscreen can create the illusion of greater height, and atmospheric haze the illusion of being at a greater distance from the runway. The pilot who does not recognize these illusions will fly a lower approach. Penetration of fog can create the illusion of pitching up. The pilot who does not recognize this illusion will steepen the approach, often quite abruptly.

(f) Ground lighting illusions — Lights along a straight path, such as a road, and even lights on moving trains can be mistaken for runway and approach lights. Bright runway and approach lighting systems, especially where few lights illuminate the surrounding terrain, may create the illusion of less distance to the runway. The pilot who does not recognize this illusion will fly a higher approach. Conversely, the pilot overflying terrain which has few lights to provide height cues may make a lower than normal approach.

605. VISION IN FLIGHT

a. Introduction

(1) Of the body senses, vision is the most important for safe flight. Major factors that determine how effectively vision can be used are the level of illumination and the technique of scanning the sky for other aircraft.

b. Vision Under Dim and Bright Illumination

(1) Under conditions of dim illumination, small print and colors on aeronautical charts and aircraft instruments become unreadable unless adequate cockpit lighting is available. Moreover, another aircraft must be much closer to be seen unless its navigation lights are on.

(2) In darkness, vision becomes more sensitive to light, a process called dark adaptation. Although exposure to total darkness for at least 30 minutes is required for complete dark adaptation, the pilot can achieve a moderate degree of dark adaptation within 20 minutes under dim red cockpit lighting. Since red light severely distorts colors, es-

pecially on aeronautical charts, and can cause serious difficulty in focusing the eyes on objects inside the aircraft, its use is advisable only where optimum outside night vision capability is necessary. Even so, white cockpit lighting must be available when needed for map and instrument reading, especially under IFR conditions. Dark adaptation is impaired by exposure to cabin pressure altitudes above 5,000 feet, carbon monoxide inhaled in smoking and from exhaust fumes, deficiency of Vitamin A in the diet, and by prolonged exposure to bright sunlight. Since any degree of dark adaptation is lost within a few seconds of viewing a bright light, the pilot should close one eye when using a light to preserve some degree of night vision.

(3) Excessive illumination, especially from light reflected off the canopy, surfaces inside the aircraft, clouds, water, snow, and desert terrain, can produce glare, with uncomfortable squinting, watering of the eyes, and even temporary blindness. Sunglasses for protection from glare should absorb at least 85 percent of visible light (15 percent transmittance) and all colors equally (neutral transmittance), with negligible image distortion from refractive and prismatic errors.

c. Scanning for Other Aircraft

(1) Scanning the sky for other aircraft is a key factor in collision avoidance. It should be used continuously by the pilot and copilot (or right seat passenger) to cover all areas of the sky visible from the cockpit. Although pilots must meet specific visual acuity requirements, the ability to read an eye chart does not ensure that one will be able to efficiently spot other aircraft. Pilots must develop an effective scanning technique which maximizes one's visual capabilities. The probability of spotting a potential collision threat obviously increases with the time spent looking outside the cockpit. Thus, one must use timesharing techniques to efficiently scan the surrounding airspace while monitoring instruments as well.

(2) While the eyes can observe an approximate 200 degree arc of the horizon at one glance, only a very small center area called the fovea, in the rear of the eye, has the ability to send clear, sharply focused messages to the brain. All other visual information that is not processed directly through the fovea will be of less detail. An aircraft at a distance of 7 miles which appears in sharp focus within the foveal center of vision would have to be as close as 7/10 of a mile in order to be recognized if it were outside of foveal vision. Because the eyes can focus only on this narrow viewing area, effective scanning is accomplished with a series of short, regularly spaced eye movements that bring successive areas of the sky into the central visual field. Each movement should not exceed 10 degrees, and each area should be observed for at least one second to enable detection. Although horizontal back-and-forth eye movements seem preferred by most pilots, each pilot should develop a scanning pattern that is most comfortable and then adhere to it to assure optimum scanning.

(3) Studies show that the time a pilot spends on visual tasks inside the cabin should represent no more that 1/4 to 1/3 of the scan time outside, or no more than 4 to 5 seconds on the instrument panel for every 16 seconds outside. Since the brain is already trained to process sight information that is presented from left to right, one may find it easier to start scanning over the left shoulder and proceed across the windshield to the right.

(4) Pilots should realize that their eyes may require several seconds to refocus when switching views between items in the cockpit and distant objects. The eyes will also tire more quickly when forced to adjust to distances immediately after close-up focus, as required for scanning the instrument panel. Eye fatique can be reduced by looking from the instrument panel to the left wing past the wing tip to the center of the first scan quandrant when beginning the exterior scan. After having scanned from left to right, allow the eyes to return to the cabin along the right wing from its tip inward. Once back inside, one should automatically commence the panel scan.

(5) Effective scanning also helps avoid "empty-field myopia." This condition usually occurs when flying above the clouds or in a haze layer that provides nothing specific to focus on outside the aircraft. This causes the eyes to relax and seek a comfortable focal distance which may range from 10 to 30 feet. For the pilot, this means looking without seeing, which is dangerous.

606. AEROBATIC FLIGHT

a. Airmen planning to engage in aerobatics should be aware of the physiological stresses associated with accelerative forces during aerobatic maneuvers. Many prospective aerobatic trainees enthusiastically enter aerobatic instruction but find their first experiences with G forces to be unanticipated and very uncomfortable. To minimize or avoid potential adverse effects, the aerobatic instructor and trainee must have a basic understanding of the physiology of G force adaptation.

b. Forces experienced with a rapid push-over maneuver result in the blood and body organs being displaced toward the head. Depending on forces involved and individual tolerance, the airman may experience discomfort, headache, "red-out," and even unconsciousness.

c. Forces experienced with a rapid pull-up maneuver result in the blood and body organ displacement toward the lower part of the body away from the head. Since the brain requires continuous blood circulation for an adequate oxygen supply, there is a physiologic limit to the time the pilot can tolerate higher forces before losing consciousness. As the blood circulation to the brain decreases as a result of forces involved, the airman will experience "narrowing" of visual fields, "gray-out," "black-out," and unconsciousness. Even a brief loss of consciousness in a maneuver can lead to improper control movement causing structural failure of the aircraft or collision with another object or terrain.

d. In steep turns, the centrifugal forces tend to push the pilot into the seat, thereby resulting in blood and body organ displacement toward the lower part of the body as in the case of rapid pull-up maneuvers and with the same physiologic effects and symptoms.

e. Physiologically, humans progressively adapt to imposed strains and stress, and with practice, any maneuver will have decreasing effect. Tolerance to G forces is dependent on human physiology and the individual pilot. These factors include the skeletal anatomy, the cardiovascular architecture, the nervous system, the quality of the blood, the general physical state, and experience and recency of exposure. The airman should consult an Aviation Medical Examiner prior to aerobatic training and be aware that poor

physical condition can reduce tolerance to accelerative forces.

f. The above information provides the airman a brief summary of the physiologic effects of G forces. It does not address methods of "counteracting" these effects. There are numerous references on the subject of G forces during aerobatics available to the airman. Among these are "G Effects on the Pilot During Aerobatics," (FAA-AM-72-28), "G Incapacitation in Aerobatic Pilots: A Flight Hazard" (FAA-AM-82-13). These are available from the National Technical Information Service, Springfield, Virginia 22161. See also FAA Advisory Circular — 91-61, "A HAZARD IN AEROBATICS: EFFECTS OF G-FORCES ON PILOTS."

607. JUDGMENT ASPECTS OF COLLISION AVOIDANCE

a. Introduction

(1) The most important aspects of vision and the techniques to scan for other aircraft are described in Paragraph 605 above. Pilots should also be familiar with the following information to reduce the possibility of mid-air collisions.

b. Determining Relative Altitude

(1) Use the horizon as a reference point. If the other aircraft is above the horizon, it is probably on a higher flight path. If the aircraft appears to be below the horizon, it is probably flying at a lower altitude.

c. Taking Appropriate Action

(1) Pilots should be familiar with rules on right-of-way, so if an aircraft is on an obvious collision course, one can take immediately evasive action, preferably in compliance with applicable Federal Aviation Regulations.

d. Consider Multiple Threats

(1) The decision to climb, descend, or turn is a matter of personal judgment, but one should anticipate that the other pilot may also be making a quick maneuver. Watch the other aircraft during the maneuver and begin your scanning again immediately since there may be other aircraft in the area.

e. Collision Course Targets

(1) Any aircraft that appears to have no relative motion and stays in one scan quadrant is likely to be on a collision course. Also, if a target shows no lateral or vertical motion, but increases in size, *take evasive action.*

f. Recognize High Hazard Areas

(1) Airways and especially VORs and airport traffic areas are places where aircraft tend to cluster.

(2) Remember, most collisions occur during days when the weather is good. Being in a "radar environment" still requires vigilance to avoid collisions.

g. Cockpit Management

(1) Studying maps, checklists, and manuals before flight, with other proper preflight planning (e.g., noting necessary radio frequencies) and organizing cockpit materials, can reduce the amount of time required to look at these items during flight, permitting more scan time.

h. Windshield Conditions

(1) Dirty or bug-smeared windshields can greatly reduce the ability of pilots to see other aircraft. Keep a clean windshield.

i. Visibility Conditions

(1) Smoke, haze, dust, rain, and flying towards the sun can also greatly reduce the ability to detect targets.

j. Visual Obstructions in the Cockpit

(1) Pilots need to move their heads to see around blind spots caused by fixed aircraft structures, such as door posts, wings, etc. It will be necessary at times to maneuver the aircraft (e.g., lift a wing) to facilitate seeing.

(2) Pilots must insure curtains and other cockpit objects (e.g., maps on glare shield) are removed and stowed during flight.

k. Lights On

(1) Day or night, use of exterior lights can greatly increase the conspicuity of any aircraft.

(2) Keep interior lights low at night.

l. ATC support

(1) ATC facilities often provide radar traffic advisories on a workload-permitting basis. Flight through the new Airport Radar Service Areas (ARSAs) requires communication with ATC. Use this support whenever possible or when required.

608—619. RESERVED

Chapter 8. AERONAUTICAL CHARTS AND RELATED PUBLICATIONS

Section 1. TYPES OF CHARTS AVAILABLE

620. GENERAL

Aeronautical charts for the U.S. and its territories and possessions are produced by the National Ocean Service (NOS), a part of the Department of Commerce, from information furnished by the FAA.

621. OBTAINING AERONAUTICAL CHARTS

En route Aeronautical Charts, En route Supplements, Approach Procedure Charts, Regional Airport/Facility Directories and other publications described in this Chapter are available upon subscription from the:

National Ocean Service
NOAA Distribution Branch (N/CG33)
Riverdale, Maryland 20737

622. TYPES OF CHARTS AVAILABLE

- Sectional and VFR Terminal Area Charts
- World Aeronautical Charts (U.S.)
- En route Low Altitude Charts
- En route High Altitude Charts
- Alaska En route Charts (Low and High)
- Aircraft Position Charts
- Planning Charts
- Instrument Approach Procedure Charts
- Standard Instrument Departure (SID) Charts
- Standard Terminal Arrival (STAR) Charts
- Alaska Terminal Publication

623. GENERAL DESCRIPTION OF EACH CHART SERIES

a. Sectional and VFR Terminal Area Charts

(1) These charts are designed for visual navigation of slow and medium speed aircraft. They are produced to the following scales:

Sectional Charts — 1:500,000 (1 in = 6.86 NM)
VFR Terminal Area Charts — 1:250,000 (1 in = 3.43 NM)

(2) Topographic information features the portrayal of relief and a judicious selection of visual check points for VFR flight (Terminal Area Charts include populated places, drainage, roads, railroads, and other distinctive landmarks). Aeronautical information includes visual and radio aids to navigation, aerodromes, controlled airspace, restricted areas, obstructions, and related data. The VFR Terminal Area Charts also depict the airspace designated as "terminal control area" which provides for the control or segregation of all aircraft within the terminal control area. The Puerto Rico-Virgin Islands Terminal Area Chart contains basically the same information as that shown on the Sectional and Terminal Area Chart. It includes the Gulf of Mexico and Caribbean Planning Chart on the reverse side (See PLANNING CHARTS). Charts are revised semiannually except for several Alaskan Sectionals and the Puerto Rico-Virgin Islands Terminal Area which are revised annually.

b. World Aeronautical Charts

(1) These charts are designed to provide a standard series of aeronautical charts, covering land areas of the world, at a size and scale convenient for navigation by moderate speed aircraft. They are produced at a scale of 1:1,000,000 (1 in = 13.7 NM). Topographic information includes cities and towns, principal roads, railroads, distinctive landmarks, drainage and relief. The latter is shown by spot elevations, contours, and gradient tints. Aeronautical information includes visual and radio aids to navigation, aerodromes, airways, restricted areas, obstructions and other pertinent data. These charts are revised annually except several Alaskan charts and the Mexican/Caribbean charts which are revised every 2 years.

c. En route Low Altitude Charts

(1) These charts are designed to provide aeronautical information for en route navigation under Instrument Flight Rules (IFR) in the low altitude stratum. The series also includes En route Area Charts which furnish terminal data at a large scale in congested areas, and is included with the subscription to the series. Information includes the portrayal of L/MF and VHF airways, limits of controlled airspace, position, identification and frequencies of radio aids, selected aerodromes, minimum en route and obstruction clearance altitudes, airway distances, reporting points, special use airspace areas, military training routes and related information. Charts are printed back to back. Charts are revised every 56 days effective with the date of airspace changes. An En route Change Notice may be issued as required on the midpoint 28-day cycle.

d. En route High Altitude Charts

(1) These charts are designed to provide aeronautical information for en route navigation under IFR in the high altitude stratum. Information includes the portrayal of jet routes, position, identification and frequencies of radio aids, selected aerodromes, distances, time zones, special use airspace areas and related information. Charts are revised every 56 days effective with the date of airspace changes. An En route Change Notice may be issued as required on the midpoint 28-day cycle.

e. Alaska En route Charts (Low and High)

(1) These charts are produced in a low altitude and high altitude series with purpose and makeup identical to Low and High Altitude Charts described above. Charts are revised every 56 days effective with the date of airspace

changes. An En route Change Notice may be issued as required on the midpoint 28-day cycle.

f. Charted VFR Flyway Planning Chart

(1) These charts are designed to identify flight paths clear of the major controlled traffic flows. The program is intended to provide charts showing multiple VFR routings through high density traffic areas which may be used as an alternative to flight within TCAs. Ground references are provided as guides for improved visual navigation. These charts are not intended to discourage VFR operations within the TCAs, but are designed for information and planning purposes. They are produced at a scale of 1:250,000 (1 in = 3.43 NM). These charts are revised semi-annually and are published on the back of the existing VFR Terminal Area Charts.

g. Planning Charts

(1) ***VFR/IFR Planning Chart***

(a) These charts are designed to fulfill the requirements of preflight planning for flights under VFR/IFR. They are produced at a scale of 1:2,333,232 (1 in=32 NM). The chart is printed in two parts in such a manner that, when assembled, it forms a composite VFR Planning Chart on one side and IFR Planning Chart on the other. Information on the IFR chart includes low altitude airways and mileages, navigational facilities, special use airspace areas, time zones, airports, isogonic lines, and related data. Information on the VFR chart includes selected populated places, large bodies of water, major drainage, shaded relief, navigational facilities, airports, special use airspace areas, military training routes and related data.

(2) ***Flight Case Planning Chart***

(a) This chart is designed for preflight and en route flight planning for VFR flights. It is produced at a scale of 1:4,374,803 (1 in=60 NM). This chart contains basically the same information as the VFR/IFR Planning Chart with the addition of selected FSS and Weather Service Offices located at airport sites, parachute jumping areas, a tabulation of special use airspace areas, a mileage table listing distances between 174 major airports and a city/aerodrome location index.

(3) ***Gulf of Mexico and Caribbean Planning Chart***

(a) This chart is designated for preflight planning for VFR flights. It is produced at a scale of 1:6,270,551 (1 in=86 NM). This chart is on the reverse of the Puerto Rico-Virgin Islands Terminal Area Chart. Information includes mileage between Airports of Entry, a selection of special use airspace areas and a Directory of Aerodromes with their available facilities and servicing.

(4) ***Instrument Approach Procedure (IAP) Charts***

(a) IAP charts portray the aeronautical data which is required to execute instrument approaches to airports. These charts are published in 15 bound volumes covering the conterminous U.S. and the Puerto Rico-Virgin Islands. Each new volume is superseded by a new volume each 56 days. Changes to procedures occurring between the 56 day publication cycle is reflected in a change notice volume issued on the 28 day mid cycle. These changes are in the form of a new chart. The publication of a new 56 day volume incorporates all the changes and replaces the preceding volume and the change notice. The bound volumes are 5 3/8 x 8 1/4 inches and bound on the top edge. Each chart contained depicts the IAP, all related navigation data, communications information and an airport diagram. Each procedure is designated for use with a specific electronic navigational aid, such as ILS, VOR, NDB, RNAV, etc. Airport Taxi Charts where published, are included.

(5) ***Standard Instrument Departure (SID) Charts***

(a) These charts are designed to expedite clearance delivery and to facilitate transition between takeoff and en route operations. They are published in a bound book, 5 3/8 inches by 8 1/4 inches, and furnish pilots departure routing clearance information in graphic and textual form. These are two bound volumes which are issued every 56 days.

(6) ***Standard Terminal Arrival (STAR) Charts***

(a) These charts are designed to expedite ATC arrival route procedures and to facilitate transition between en route and instrument approach operations. These charts, published in a bound book, 5 3/8 inches by 8 1/4 inches, present to the pilot preplanned IFR ATC arrival route procedures in graphic and textual form. Each STAR procedure is presented as a separate chart and may serve a single airport or more than one airport in a given geographic location. One bound volume of STAR charts for the U.S., excluding Alaska, is issued every 56 days.

(7) ***Alaska Terminal Publication***

(a) This publication contains charts depicting all terminal flight procedures in the State of Alaska for civil and military aviation. They are

Instrument Approach Procedure (IAP) Charts.
Standard Instrument Departure (SID) Charts.
Standard Terminal Arrival (STAR) Charts.
Airport Taxi Charts.
Radar Minimums.

(b) All supplementary supporting data, i.e.: IFR Takeoff and Departure Procedures, IFR Alternate Minimums, Rate of Descent Table, Inoperative Components Table, etc., is also included.

(c) The Alaska Terminal is published in a bound book 5 3/8 inches by 8 1/4 inches, and is arranged alphabetically by airport name with all procedures appropriate to the airport following the airport name: STAR, IAP, TAXI, SID. The publication is issued every 56 days with provisions for an as required "Terminal Change" on the 28 day midpoint.

624. RELATED PUBLICATIONS

a. The Airport Facility Directory

(1) This directory is issued in seven volumes with each volume covering a specific geographic area of the conterminous U.S., including Puerto Rico and the U.S. Virgin Islands. The directory is 5 3/8 X 8 1/4 inches and is bound on the side. Each volume is reissued in its entirety each 56 days. Each volume is indexed alphabetically by state, airport, navigational aid, and ATC facility for the area of coverage. All pertinent information concerning each entry is included.

b. Alaska Supplement

(1) This supplement is a joint Civil and Military Flight Information Publication (FLIP), published and distributed every 56 days by the NOS. It is designed for use with the Flight Information Publication En route Charts, Alaska Terminal, WAC and Sectional Aeronautical Charts. This Supplement contains an Airport/Facility Directory of all airports shown on En route Charts, and those requested by appropriate agencies, communications data, navigational facilities, special notices and procedures applicable to the area of chart coverage.

c. Pacific Supplement

(1) This Chart Supplement is a Civil Flight Information Publication, published and distributed every 56 days by the NOS. It is designed for use with the Flight Information En route Publication Charts and the Sectional Aeronautical Chart covering the State of Hawaii and that area of the Pacific served by U.S. facilities. An Amendment Notice is published 4 weeks after each issue of the Supplement. This chart Supplement contains an Airport/Facility Directory of all airports open to the public, and those requested by appropriate agencies, communications data, navigational facilities, special notices and procedures applicable to the Pacific area.

d. Defense Mapping Agency Aerospace Center (DMAAC) Publications

(1) Pilotage Charts (PC/TPC) — Scale 1:500,000 used for detail preflight planning and mission analysis. Emphasis in design is on ground features significant in visual and radar, low-level high speed navigation.

(2) Jet Navigation Charts (JNC-A) — Scale 1:3,000,000. Designed to provide greater coverage than the 1:2,000,000 scale Jet Navigation Charts described below. Uses include preflight planning and en route navigation by long-range jet aircraft with dead reckoning, radar, celestial and grid navigation capabilities.

(3) LORAN Navigation & Consol LORAN Navigation Charts (LJC/CJC) — Scale 1:2,000,000. Used for preflight planning and in-flight navigation on long-range flights in the Polar areas and adjacent regions utilizing LORAN and Consol navigation aids.

(4) Continental Entry Chart (CEC) — Scale 1:2,000,000. Used for CONSOLAN and LORAN navigation for entry into the U.S. when a high degree of accuracy is required to comply with Air Defense identification and reporting procedures. Also suitable as a basic dead reckoning sheet and for celestial navigation.

(5) Aerospace Planning Chart (ASC) — Scale 1:9,000,000 and 1:18,000,000. Six charts at each scale and with various projections, cover the world. Charts are useful for general planning, briefings, and studies.

(6) Air Distance/Geography Chart (GH-2, 2a) — Scales 1:25,000,000 and 1:50,000,000. This chart shows great circle distances between major airports. It also shows major cities, international boundaries, shaded relief and gradient tints.

(7) LORAN C Navigation Chart (LCC) — Scale 1:3,000,000. Primarily designed for preflight and in-flight long-range navigation where LORAN C is used as the basic navigation aid.

(8) DOD Weather Plotting Chart (WPC) — Various scales. Designed as nonnavigational outline charts which depict locations and identifications of meterological observing stations. Primarily used to forecast and monitor weather and atmospheric conditions throughout the world.

(9) Flight Information Publications (FLIP) — These include En route Low Altitude and High Altitude Charts, En route Supplements, Terminal (Instrument Approach Charts), and other informational publications for various areas of the world.

NOTE.— FLIP. Terminal publications do not necessarily include all instrument approach procedures for all airports. They include only those required for military operations. More complete information and price may be obtained from National Ocean Service, Distribution Branch.

(10) World Aeronautical (WAC) and Operational Navigation Charts (ONC) — The Operational Navigation Charts (ONC) have the same purpose and contain essentially the same information as the WAC series except the terrain is portrayed by shaded relief as well as contours. The ONC series is replacing the WAC series and the WAC's will be available only where the ONC's have not been issued. ONC's are 42 X 57 1/2 inches, WAC's are 22 X 30 inches. These charts are revised on a regular schedule.

(11) Jet Navigation Charts — These charts are designed to fulfill the requirements for long-range high altitude, high speed navigation. They are produced at a scale of 1:2,000,000 (1 in=27.4 NM). Topographic features include large cities, roads, railroads, drainage and relief. The latter is indicated by contours, spot elevations and gradient tints. All aeronautical information necessary to conform to the purpose of the chart is shown. This includes restricted areas, L/MF and VOR ranges, radio beacons and a selection of standard broadcasting stations and aerodromes. The runway patterns of the aerodromes are shown to exaggerated scale in order that they may be readily identified as visual landmarks. Universal Jet Navigation Charts are used as plotting charts in the training and practice of celestial and dead reckoning navigation. They may also be used for grid navigational training.

(12) Global Navigational Charts — These charts are designed to fulfill the requirements for aeronautical planning, operations over long distances, and en route navigation in long-range, high altitude, high speed aircraft. They are produced at a scale of 1:5,000,000 (1 in=68.58 NM). Global Navigation Charts (GNC) are 42 by 57 1/2 inches. They show principal cities, towns and drainage, primary roads and railroads, prominent culture and shadient relief augmented with tints and spot elevations. Aeronautical data includes radio aids to navigation, aerodrome and restricted areas. Charts 1 and 26 have a polar navigation grid and charts 2 and 6 have sub-polar navigation grids. Global LORAN Navigation Charts (GLC) are the same size and scale and cover the same area as the GNC charts. They contain major cities only, coast lines, major lakes and rivers, and land tint. No relief or vegetation. Aeronautical data includes radio aids to navigation and LORAN lines of position.

625. AUXILIARY CHARTS

a. Airport Obstruction Charts (OC):

(1) These large scale (1:12,000) charts of airports show runways and flight paths for landing and takeoff, together with the positions and elevations of the objects which are potential hazards to these operations. The charts are used in determining the maximum safe takeoff and landing gross weight of civil aircraft, in determining airport instrument approach and landing procedures, and to provide data for engineering plans relative to clearing of obstructions and improvement of airport facilities.

b. Military Training Routes:

(1) Charts and Booklet: The Defense Mapping Agency Aerospace Center (DMAAC) publishes a narrative description in booklet form and charts depicting the IFR and VFR Training Routes.

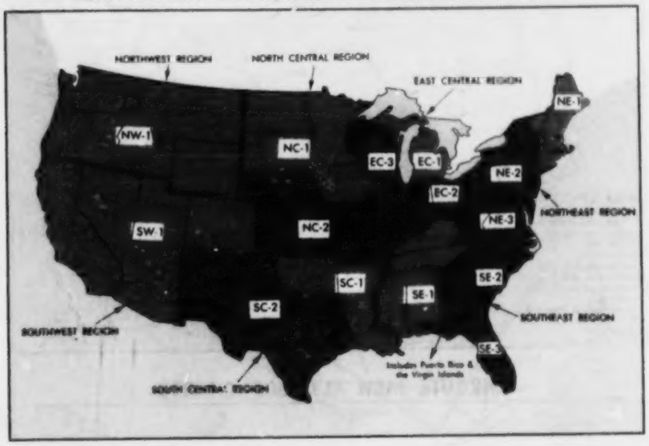
(2) The charts and booklet are published every 56 days. Both the charts and narrative route description booklet are available to the general public as a brochure by single copy or annual subscription.

(3) Subscription and single-copy requests should be for the "DOD Area Planning AP/1B, Military Training Routes".

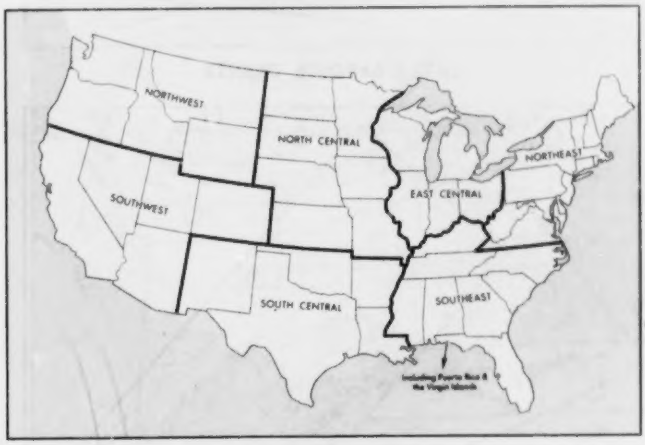
NOTE.— The DOD provides these booklets and charts to each FSS for use in preflight pilot briefings. Pilots should review this information to acquaint themselves with those routes that are located along their route of flight and in the vicinity of the airports from which they operate.

626—999. RESERVED

INSTRUMENT APPROACH PROCEDURE CHARTS

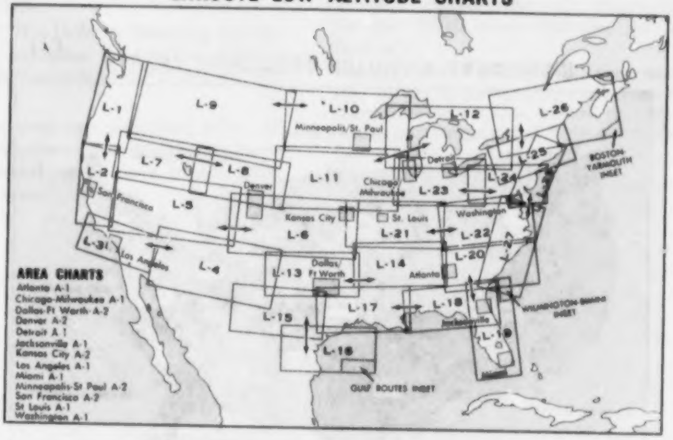

NORTHWEST REGION
NORTH CENTRAL REGION
EAST CENTRAL REGION
NE-1
NW-1
NC-1
EC-3
EC-1
NE-2
EC-2
NORTHEAST REGION
NE-3
SW-1
NC-2
SE-2
SC-1
SE-1
SC-2
SOUTHEAST REGION
SOUTHWEST REGION
SE-3
Includes Puerto Rico & the Virgin Islands
SOUTH CENTRAL REGION

AIRPORT/FACILITY DIRECTORY

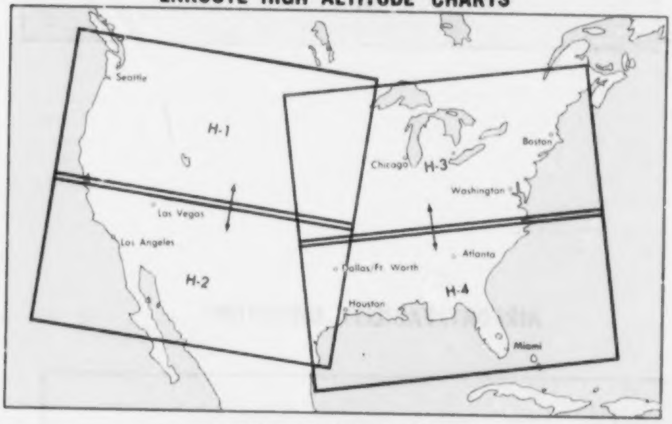

NORTHWEST
NORTH CENTRAL
NORTHEAST
EAST CENTRAL
SOUTHWEST
SOUTH CENTRAL
SOUTHEAST
Including Puerto Rico & the Virgin Islands

TYPES OF CHARTS AVAILABLE

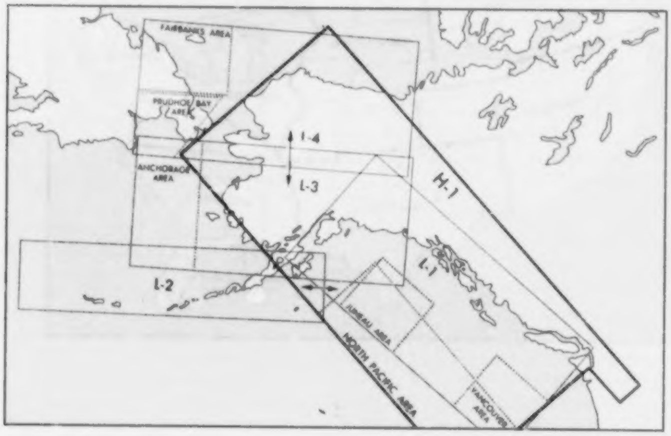
ENROUTE LOW ALTITUDE CHARTS


L-1
L-9
L-10
Minneapolis/St. Paul
L-12
L-26
L-2
L-7
L-8
L-11
Detroit
L-25
BOSTON YARMOUTH INSET
San Francisco
Denver
Chicago/Milwaukee
L-23
L-24
L-5
Kansas City
St. Louis
Washington
L-6
L-21
L-22
L-31
Los Angeles
L-4
L-13
Dallas/Ft Worth
L-14
Atlanta
L-20
L-15
L-17
L-18
Jacksonville
WILMINGTON-BIMINI INSET
L-16
L-19
GULF ROUTES INSET
AREA CHARTS
Atlanta A-1
Chicago-Milwaukee A-1
Dallas-Ft Worth A-2
Denver A-2
Detroit A-1
Jacksonville A-1
Kansas City A-2
Los Angeles A-1
Miami A-1
Minneapolis-St Paul A-2
San Francisco A-2
St Louis A-1
Washington A-1

ENROUTE HIGH ALTITUDE CHARTS

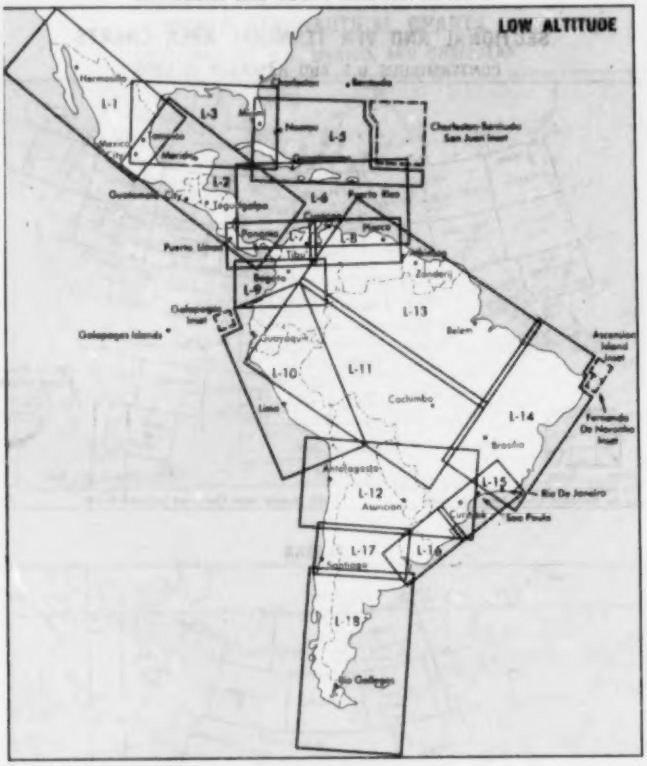

Seattle
H-1
Chicago
H-3
Boston
Washington
Las Vegas
Los Angeles
Atlanta
Dallas/Ft. Worth
H-2
Houston
H-4
Miami

ALASKA ENROUTE CHARTS

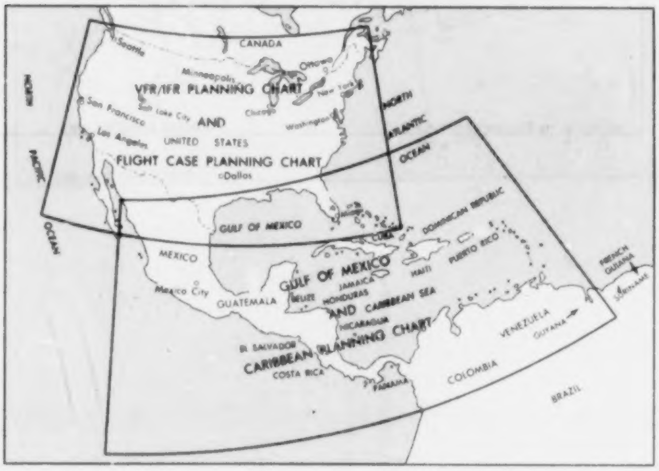

FAIRBANKS AREA
PRUDHOE BAY AREA
L-4
L-3
ANCHORAGE AREA
H-1
L-1
L-2
JUNEAU AREA
NORTH PACIFIC AREA
VANCOUVER AREA

FLIGHT INFORMATION PUBLICATIONS

CARIBBEAN AND SOUTH AMERICA ENROUTE

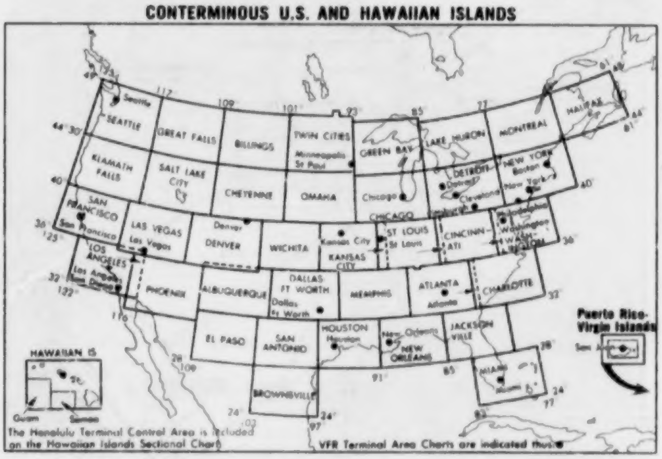

LOW ALTITUDE
Hermosillo
L-1
Mexico City
L-3
Charleston
Bermuda
Nassau
L-5
Charleston-Bermuda San Juan Inset
L-2
Guatemala City
Tegucigalpa
L-6
Puerto Rico
Panama
L-7
L-8
Puerto Limon
Bogota
L-9
Zanderij
L-13
Galapagos Inset
Galapagos Islands
Guayaquil
Belem
Ascension Island Inset
L-10
L-11
Lima
Cachimbo
L-14
Fernando De Noronha Inset
Brasilia
Antofagasta
L-15
L-12
Asuncion
Rio De Janeiro
Curitiba
Sao Paulo
L-17
L-16
Santiago
L-19
Rio Gallegos

PLANNING CHARTS


CANADA
Seattle
Minneapolis
Ottawa
VFR/IFR PLANNING CHART
New York
NORTH
San Francisco
Salt Lake City
AND
Chicago
Washington
ATLANTIC
Los Angeles
UNITED STATES
NORTH PACIFIC OCEAN
OCEAN
FLIGHT CASE PLANNING CHART
Dallas
GULF OF MEXICO
CUBA
DOMINICAN REPUBLIC
MEXICO
GULF OF MEXICO
HAITI
PUERTO RICO
FRENCH GUIANA
Mexico City
JAMAICA
GUATEMALA
BELIZE
HONDURAS
AND CARIBBEAN SEA
SURINAME
NICARAGUA
VENEZUELA
GUYANA
EL SALVADOR
CARIBBEAN PLANNING CHART
COSTA RICA
PANAMA
COLOMBIA
BRAZIL

SECTIONAL AND VFR TERMINAL AREA CHARTS

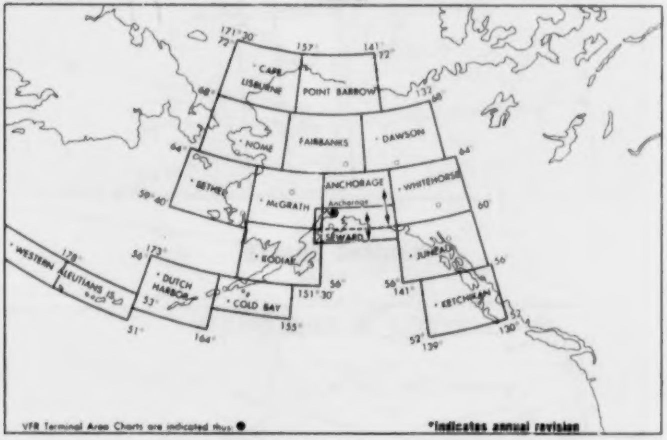
CONTERMINOUS U.S. AND HAWAIIAN ISLANDS


SEATTLE
Seattle
GREAT FALLS
BILLINGS
TWIN CITIES
Minneapolis St Paul
GREEN BAY
LAKE HURON
MONTREAL
HALIFAX
KLAMATH FALLS
SALT LAKE CITY
CHEYENNE
OMAHA
Chicago
CHICAGO
DETROIT
Detroit
Cleveland
NEW YORK
Boston
New York
SAN FRANCISCO
San Francisco
LAS VEGAS
Las Vegas
Denver
DENVER
WICHITA
Kansas City
KANSAS CITY
ST LOUIS
St Louis
CINCINNATI
Philadelphia
Washington
WASHINGTON
LOS ANGELES
Los Angeles
San Diego
PHOENIX
ALBUQUERQUE
DALLAS FT WORTH
Dallas
Ft Worth
MEMPHIS
ATLANTA
Atlanta
CHARLOTTE
EL PASO
SAN ANTONIO
HOUSTON
Houston
New Orleans
NEW ORLEANS
JACKSONVILLE
MIAMI
Miami
BROWNSVILLE
HAWAIIAN IS
Guam
Samoa
Puerto Rico-Virgin Islands
San Juan
49°
117°
109°
101°
93°
85°
77°
44°30'
40°
36°
125°
32°
122°
116°
28°
109°
24°
103°
97°
91°
85°
83°
77°
24°
28°
32°
36°
40°
44°
61°

The Honolulu Terminal Control Area is included on the Hawaiian Islands Sectional Chart

VFR Terminal Area Charts are indicated thus ●

ALASKA

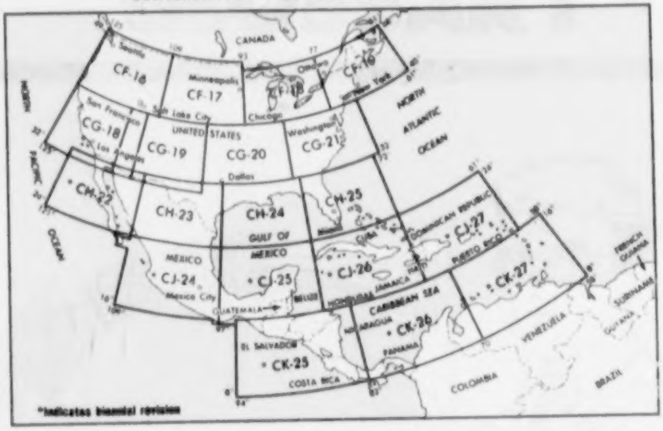

CAPE LISBURNE
POINT BARROW
NOME
FAIRBANKS
DAWSON
BETHEL
McGRATH
ANCHORAGE
Anchorage
WHITEHORSE
SEWARD
KODIAK
JUNEAU
KETCHIKAN
WESTERN ALEUTIAN IS
DUTCH HARBOR
COLD BAY
171°30'
72°
157°
141°
72°
68°
132°
68°
64°
64°
59°40'
60°
56°
173°
56°
178°
53°
51°
164°
155°
151°30'
56°
56°
141°
52°
139°
130°
52°

VFR Terminal Area Charts are indicated thus ●

***Indicates annual revision**

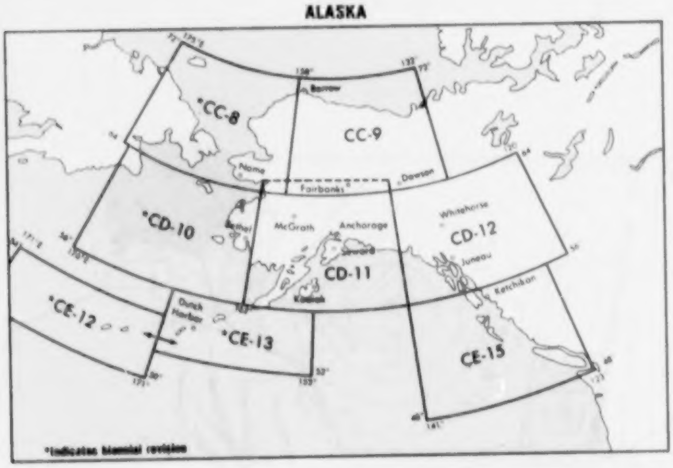
WORLD AERONAUTICAL CHARTS

CONTERMINOUS U.S., MEXICO, AND CARIBBEAN


CANADA
Seattle
CF-16
Minneapolis
CF-17
Ottawa
CF-18
CF-19
New York
NORTH PACIFIC OCEAN
San Francisco
CG-18
Salt Lake City
Chicago
UNITED STATES
Los Angeles
CG-19
CG-20
Washington
CG-21
NORTH ATLANTIC OCEAN
Dallas
*CH-22
CH-23
CH-24
CH-25
GULF OF MEXICO
CUBA
DOMINICAN REPUBLIC
*CJ-27
PUERTO RICO
MEXICO
*CJ-24
Mexico City
*CJ-25
*CJ-26
JAMAICA
HAITI
BELIZE
GUATEMALA
HONDURAS
CARIBBEAN SEA
*CK-27
FRENCH GUIANA
SURINAME
GUYANA
VENEZUELA
NICARAGUA
*CK-26
PANAMA
EL SALVADOR
*CK-25
COSTA RICA
COLOMBIA
BRAZIL

*Indicates biennial revision

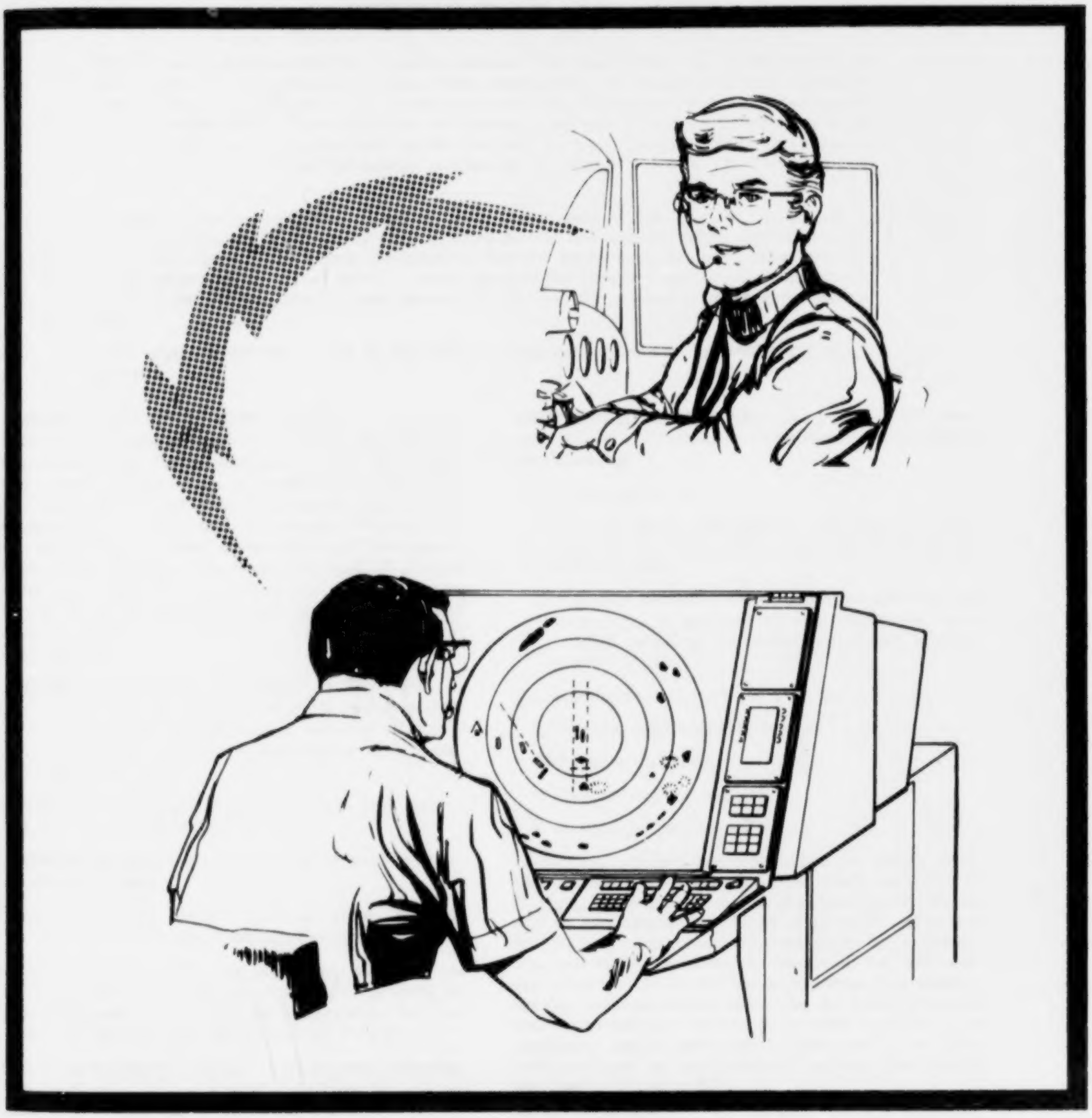
ALASKA


*CC-8
Barrow
CC-9
Nome
Fairbanks
Dawson
*CD-10
Bethel
McGrath
Anchorage
Whitehorse
CD-12
Seward
Juneau
CD-11
Kodiak
Ketchikan
*CE-12
Dutch Harbor
*CE-13
CE-15

*Indicates biennial revision

NOTES

PILOT/CONTROLLER GLOSSARY



U.S. Department of Transportation

Federal Aviation Administration

PILOT/CONTROLLER GLOSSARY

DECEMBER 18, 1986

This Glossary was compiled to promote a common understanding of the terms used in the Air Traffic Control system. It includes those terms which are intended for pilot/controller communications. Those terms most frequently used in pilot/controller communications are printed in ***bold italics***. The definitions are primarily defined in an operational sense applicable to both users and operators of the National Airspace System. Use of the Glossary will preclude any misunderstandings concerning the system's design, function, and purpose.

Because of the international nature of flying, terms used in the "Lexicon," published by the International Civil Aviation Organization (ICAO), are included when they differ from FAA definitions. These terms are *italicized*. For the reader's convenience, there are also cross references to related terms in other parts of the Glossary and to other documents, such as the Federal Aviation Regulations (FAR's) and the Airman's Information Manual (AIM).

This Glossary will be revised as necessary to maintain a common understanding of the system.

ABBREVIATED IFR FLIGHT PLANS— An authorization by ATC requiring pilots to submit only that information needed for the purpose of ATC. It includes only a small portion of the usual IFR flight plan information. In certain instances, this may be only aircraft identification, location, and pilot request. Other information may be requested if needed by ATC for separation/control purposes. It is frequently used by aircraft which are airborne and desire an instrument approach or by aircraft which are on the ground and desire a climb to VFR-on-top. (See VFR-ON-TOP) (Refer to AIM)

ABEAM— An aircraft is "abeam" a fix, point, or object when that fix, point, or object is approximately 90 degrees to the right or left of the aircraft track. Abeam indicates a general position rather than a precise point.

ABORT— To terminate a preplanned aircraft maneuver; e.g., an aborted takeoff.

ACKNOWLEDGE— Let me know that you have received my message.

ICAO—ACKNOWLEDGE— Let me know that you have received and understood this message.

ACROBATIC FLIGHT— An intentional maneuver involving an abrupt change in an aircraft's attitude, an abnormal attitude, or abnormal acceleration not necessary for normal flight. (Refer to FAR Part 91)

*ICAO—ACROBATIC FLIGHT—*Maneuvers intentionally performed by an aircraft involving an abrupt change in its attitude, an abnormal attitude, or an abnormal variation in speed.

ADDITIONAL SERVICES— Advisory information provided by ATC which includes but is not limited to the following:

1. Traffic advisories.
2. Vectors, when requested by the pilot, to assist aircraft receiving traffic advisories to avoid observed traffic.
3. Altitude deviation information of 300 feet or more from an assigned altitude as observed on a verified (reading correctly) automatic altitude readout (Mode C).
4. Advisories that traffic is no longer a factor.
5. Weather and chaff information.
6. Weather assistance.
7. Bird activity information.
8. Holding pattern surveillance.

Additional services are provided to the extent possible contingent only upon the controller's capability to fit them into the performance of higher priority duties and on the basis of limitations of the radar, volume of traffic, frequency congestion, and controller workload. The controller has complete discretion for determining if he is able to provide or continue to provide a service in a particular case. The controller's reason not to provide or continue to provide a service in a particular case is not subject to question by the pilot and need not be made known to him. (See Traffic Advisories) (Refer to AIM)

ADMINISTRATOR— The Federal Aviation Administrator or any person to whom he has delegated his authority in the matter concerned.

ADVISE INTENTIONS— Tell me what you plan to do.

ADVISORY— Advice and information provided to assist pilots in the safe conduct of flight and aircraft movement. (See Advisory Service)

ADVISORY FREQUENCY— The appropriate frequency to be used for Airport Advisory Service. (See Airport Advisory Service and UNICOM) (Refer to Advisory Circular No. 90-42 and AIM)

ADVISORY SERVICE— Advice and information provided by a facility to assist pilots in the safe conduct of flight and aircraft movement. (See Airport Advisory Service, Traffic Advisories, Safety Alerts, Additional Services, Radar Advisory, En Route Flight Advisory Service) (Refer to AIM)

AERIAL REFUELING/IN-FLIGHT REFUELING— A procedure used by the military to transfer fuel from one aircraft to another during flight. (Refer to VFR/IFR Wall Planning Charts).

AERODROME— A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure, and movement of aircraft.

AERONAUTICAL BEACON— A visual NAVAID displaying flashes of white and/or colored light to indicate the location of an airport, a heliport, a landmark, a certain point of a Federal airway in mountainous terrain, or an obstruction. (See Airport Rotating Beacon) (Refer to AIM)

AERONAUTICAL CHART— A map used in air navigation containing all or part of the following: Topographic features, hazards and obstructions, navigation aids, navigation routes, designated airspace, and airports. Commonly used aeronautical charts are:

1. Sectional Charts—1:500,000—Designed for visual navigation of slow or medium speed aircraft. Topographic information on these charts features the portrayal of relief and a judicious selection of visual check points for VFR flight. Aeronautical information includes visual and radio aids to navigation, airports, controlled airspace, restricted areas, obstructions, and related data.
2. VFR Terminal Area Charts—1:250,000—Depict Terminal Control Area (TCA) airspace which provides for the control or segregation of all the aircraft within the TCA. The chart depicts topographic information and aeronautical information which includes visual and radio aids to navigation, airports, controlled airspace, restricted areas, obstructions, and related data.
3. World Aeronautical Charts (WAC)—1:1,000,000—Provide a standard series of aeronautical charts covering land areas of the world at a size and scale convenient for navigation by moderate speed aircraft. Topographic information includes cities and towns, principal roads, railroads, distinctive landmarks, drainage, and relief. Aeronautical information includes visual and radio aids to navigation, airports, airways, restricted areas, obstructions, and other pertinent data.
4. En Route Low Altitude Charts—Provide aeronautical information for en route instrument navigation (IFR) in the low altitude stratum. Information includes the portrayal of airways, limits of controlled airspace, position identification and frequencies of radio aids, selected airports, minimum en route and minimum obstruction clearance altitudes, airway distances, reporting points, restricted areas, and related data. Area charts, which are a part of this series, furnish terminal data at a larger scale in congested areas.
5. En Route High Altitude Charts—Provide aeronautical information for en route instrument navigation (IFR) in the high altitude stratum. Information includes the portrayal of jet routes, identification and frequencies of radio aids, selected airports, distances, time zones, special use airspace, and related information.
6. Instrument Approach Procedures (IAP) Charts—Portray the aeronautical data which is required to execute an instrument approach to an airport. These charts depict the procedures, including all related data, and the airport diagram. Each procedure is designated for use with a specific type of electronic navigation system including NDB, TACAN, VOR, ILS/MLS, and RNAV. These charts are identified by the type of navigational aid(s) which provide final approach guidance.
7. Standard Instrument Departure (SID) Charts—Designed to expedite clearance delivery and to facilitate transition between takeoff and en route operations. Each SID procedure is presented as a separate chart and may serve a single airport or more than one airport in a given geographical location.
8. Standard Terminal Arrival (STAR) Charts— Designed to expedite air traffic control arrival procedures and to facilitate transition between en route and instrument approach operations. Each STAR procedure is presented as a separate chart and may serve a single airport or more than one airport in a given geographical location.
9. Airport Taxi Charts—Designed to expedite the efficient and safe flow of ground traffic at an airport. These charts are identified by the official airport name; e.g., Washington National Airport.

ICAO—AERONAUTICAL CHART—A representation of a portion of the earth, its culture and relief, specifically designated to meet the requirements of air navigation.

AFFIRMATIVE— Yes.

AIR CARRIER DISTRICT OFFICE/ACDO— An FAA field office serving an assigned geographical area, staffed with Flight Standards personnel serving the aviation industry and the general public on matters related to the certification and operation of scheduled air carriers and other large aircraft operations.

AIRCRAFT— Device/s that are used or intended to be used for flight in the air, and when used in air traffic control terminology, may include the flight crew.

ICAO-AIRCRAFT—Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface.

AIRCRAFT APPROACH CATEGORY— A grouping of aircraft based on a speed of 1.3 times the stall speed in the landing configuration at maximum gross landing weight. An aircraft shall fit in only one category. If it is necessary to maneuver at speeds in excess of the upper limit of a speed range for a category, the minimums for the next higher category should be used. For example, an aircraft which falls in Category A, but is circling to land at a speed in excess of 91 knots, should use the approach Category B minimums when circling to land. The categories are as follows:

1. Category A—Speed less than 91 knots.
2. Category B—Speed 91 knots or more but less than 121 knots.
3. Category C—Speed 121 knots or more but less than 141 knots.
4. Category D—Speed 141 knots or more but less than 166 knots.
5. Category E—Speed 166 knots or more.

(Refer to FAR Parts 1 and 97)

AIRCRAFT CLASSES— For the purposes of Wake Turbulence Separation Minima, ATC classifies aircraft as Heavy, Large, and Small as follows:

1. Heavy—Aircraft capable of takeoff weights of 300,000 pounds or more whether or not they are operating at this weight during a particular phase of flight.
2. Large—Aircraft of more than 12,500 pounds, maximum certificated takeoff weight, up to 300,000 pounds.
3. Small—Aircraft of 12,500 pounds or less maximum certificated takeoff weight. (Refer to AIM)

AIR DEFENSE EMERGENCY— A military emergency condition declared by a designated authority. This condition exists when an attack upon the continental U.S., Alaska, Canada, or U.S. installations in Greenland by hostile aircraft or missiles is considered probable, is imminent, or is taking place. (Refer to AIM)

AIR DEFENSE IDENTIFICATION ZONE/ADIZ— The area of airspace over land or water, extending upward from the surface, within which the ready identification, the location, and the control of aircraft are required in the interest of national security.

1. Domestic Air Defense Identification Zone— An ADIZ within the United States along an international boundary of the United States.
2. Coastal Air Defense Identification Zone— An ADIZ over the coastal waters of the United States.
3. Distant Early Warning Identification Zone (DEWIZ)— An ADIZ over the coastal waters of the State of Alaska.

ADIZ locations and operating and flight plan requirements for civil aircraft operations are specified in FAR Part 99. (Refer to AIM)

AIRMAN'S INFORMATION MANUAL/AIM— A publication containing Basic Flight Information and ATC Procedures designed primarily as a pilot's instructional manual for use in the National Airspace System of the United States.

ICAO-AERONAUTICAL INFORMATION PUBLICATION—A publication issued by or with the authority of a state and containing aeronautical information of a lasting character essential to air navigation.

AIRMET **/WA/AIRMAN'S METEOROLOGICAL INFORMATION—** In-flight weather advisories issued only to amend the area forecast concerning weather phenomena which are of operational interest to all aircraft and potentially hazardous to aircraft having limited capability because of lack of equipment, instrumentation, or pilot qualifications. AIRMET's concern weather of less severity than that covered by SIGMET's or Convective SIGMET's. AIRMET's cover moderate icing, moderate turbulence, sustained winds of 30 knots or more at the surface, widespread areas of ceilings less than 1,000 feet and/or visibility less than 3 miles, and extensive mountain obscurement. (See SIGMET, Convective SIGMET, and CWA) (Refer to AIM)

AIR NAVIGATION FACILITY— Any facility used in, available for use in, or designed for use in, aid of air navigation, including landing areas, lights, any apparatus or equipment for disseminating weather information, for signaling, for radio-directional finding, or for radio or other electrical communication, and any other structure or mechanism having a similar purpose for guiding or controlling flight in the air or the landing and take-off of aircraft. (See Navigational Aid)

AIRPORT— An area on land or water that is used or intended to be used for the landing and takeoff of aircraft and includes its buildings and facilities, if any.

AIRPORT ADVISORY AREA— The area within ten miles of an airport without a control tower or where the tower is not in operation, and on which a Flight Service Station is located. (See Airport Advisory Service) (Refer to AIM)

AIRPORT ADVISORY SERVICE/AAS— A service provided by flight service stations located at airports not serviced by a control tower. This service consists of providing information to arriving and departing aircraft concerning wind direction and speed, favored runway, altimeter setting, pertinent known traffic, pertinent known field conditions, airport taxi routes and traffic patterns, and authorized instrument approach procedures. This information is advisory in nature and does not constitute an ATC clearance. (See Airport Advisory Area)

AIRPORT ELEVATION/FIELD ELEVATION— The highest point of an airport's usable runways measured in feet from mean sea level. (See Touchdown Zone Elevation)

ICAO-AERODROME ELEVATION—The elevation of the highest point of the landing area.

AIRPORT/FACILITY DIRECTORY— A publication designed primarily as a pilot's operational manual containing all airports, seaplane bases, and heliports open to the public including communications data, navigational facilities, and certain special notices and procedures. This publication is issued in seven volumes according to geographical area.

AIRPORT INFORMATION DESK/AID— An airport unmanned facility designed for pilot self-service briefing, flight planning, and filing of flight plans. (Refer to AIM)

AIRPORT LIGHTING— Various lighting aids that may be installed on an airport. Types of airport lighting include:

1. Approach Light System/ALS—An airport lighting facility which provides visual guidance to landing aircraft by radiating light beams in a directional pattern by which the pilot aligns the aircraft with the extended centerline of the runway on his final approach for landing.

   Condenser-Discharge Sequential Flashing Lights/Sequenced Flashing Lights may be installed in conjunction with the ALS at some airports. Types of Approach Light Systems are:

   a. ALSF-1—Approach Light System with Sequenced Flashing Lights in ILS Cat-I configuration.
   b. ALSF-2—Approach Light System with Sequenced Flashing Lights in ILS Cat-II configuration. The ALSF-2 may operate as an SSALR when weather conditions permit.
   c. SSALF—Simplified Short Approach Light System with Sequenced Flashing Lights.
   d. SSALR—Simplified Short Approach Light System with Runway Alignment Indicator Lights.
   e. MALSF—Medium Intensity Approach Light System with Sequenced Flashing Lights.
   f. MALSR—Medium Intensity Approach Light System with Runway Alignment Indicator Lights.
   g. LDIN—Sequenced Flashing Lead-in Lights.
   h. RAIL—Runway Alignment Indicator Lights (Sequenced Flashing Lights which are installed only in combination with other light systems).
   i. ODALS—Omnidirectional Approach Lighting System consists of seven omnidirectional flashing lights located in the approach area of a nonprecision runway. Five lights are located on the runway centerline extended with the first light located 300 feet from the threshold and extending at equal intervals up to 1,500 feet from the threshold. The other two lights are located, one on each side of the runway threshold, at a lateral distance of 40 feet from the runway edge, or 75 feet from the runway edge when installed on a runway equipped with a VASI. (Refer to Order 6850.2A)

2. Runway Lights/Runway Edge Lights—Lights having a prescribed angle of emission used to define the lateral limits of a runway. Runway lights are uniformly spaced at intervals of approximately 200 feet, and the intensity may be controlled or preset.

3. Touchdown Zone Lighting—Two rows of tranverse light bars located symmetrically about the runway centerline normally at 100 foot intervals. The basic system extends 3,000 feet along the runway.

4. Runway Centerline Lighting—Flush centerline lights spaced at 50-foot intervals beginning 75 feet from the landing threshold and extending to within 75 feet of the opposite end of the runway.

5. Threshold Lights—Fixed green lights arranged symmetrically left and right of the runway centerline, identifying the runway threshold.

6. Runway End Identifier Lights/REIL—Two synchronized flashing lights, one on each side of the runway threshold, which provide rapid and positive identification of the approach end of a particular runway.

7. Visual Approach Slope Indicator/VASI— An airport lighting facility providing vertical visual approach slope guidance to aircraft during approach to landing by radiating a directional pattern of high intensity red and white focused light beams which indicate to the pilot that he is "on path" if he sees red/white, "above path" if white/white, and "below path" if red/red. Some airports serving large aircraft have three-bar VASIs which provide two visual glide paths to the same runway.

8. Boundary Lights—Lights defining the perimeter of an airport or landing area. (Refer to AIM)

AIRPORT MARKING AIDS— Markings used on runway and taxiway surfaces to identify a specific runway, a runway threshold, a centerline, a hold line, etc. A runway should be marked in accordance with its present usage such as:

1. Visual.
2. Nonprecision instrument.
3. Precision instrument. (Refer to AIM)

AIRPORT RADAR SERVICE AREA / ARSA— (See Controlled Airspace)

AIRPORT ROTATING BEACON— A visual NAVAID operated at many airports. At civil airports, alternating white and green flashes indicate the location of the airport. At military airports, the beacons flash alternately white and green, but are differentiated from civil beacons by dualpeaked (two quick) white flashes between the green flashes. (See Special VFR Operations, Instrument Flight Rules) (Refer to AIM, Rotating Beacons)

ICAO-AERODROME BEACON—Aeronautical beacon used to indicate the location of an aerodrome.

AIRPORT SURFACE DETECTION EQUIPMENT/ASDE— Radar equipment specifically designed to detect all principal features on the surface of an airport, including aircraft and vehicular traffic, and to present the entire image on a radar indicator console in the control tower. Used to augment visual observation by tower personnel of aircraft and/or vehicular movements on runways and taxiways.

AIRPORT SURVEILLANCE RADAR/ASR— Approach control radar used to detect and display an aircraft's position in the terminal area. ASR provides range and azimuth information but does not provide elevation data. Coverage of the ASR can extend up to 60 miles.

AIRPORT TRAFFIC AREA— Unless otherwise specifically designated in FAR Part 93, that airspace within a horizontal radius of 5 statute miles from the geographical center of any airport at which a control tower is operating, extending from the surface up to, but not including, an altitude of 3,000 feet above the elevation of an airport. Unless otherwise authorized or required by ATC, no person may operate an aircraft within an airport traffic area except for the purpose of landing at or taking off from an airport within that area. ATC authorizations may be given as individual approval of specific operations or may be contained in written agreements between airport users and the tower concerned. (Refer to FAR, Parts 1 and 91).

AIRPORT TRAFFIC CONTROL SERVICE— A service provided by a control tower for aircraft operating on the movement area and in the vicinity of an airport. (See Movement Area, Tower)

ICAO-AERODROME CONTROL SERVICE—Air traffic control service for aerodrome traffic.

AIR ROUTE SURVEILLANCE RADAR/ARSR— Air route traffic control center (ARTCC) radar used primarily to detect and display an aircraft's position while en route between terminal areas. The ARSR enables controllers to provide radar air traffic control service when aircraft are within the ARSR coverage. In some instances, ARSR may enable an ARTCC to provide terminal radar services similar to but usually more limited than those provided by a radar approach control.

AIR ROUTE TRAFFIC CONTROL CENTER/ ARTCC— A facility established to provide air traffic control service to aircraft operating on IFR flight plans within controlled airspace and principally during the en route phase of flight. When equipment capabilities and controller workload permit, certain advisory/assistance services may be provided to VFR aircraft. (See NAS Stage A, En Route Air Traffic Control Service) (Refer to AIM)

AIRSPEED— The speed of an aircraft relative to its surrounding air mass. The unqualified term "airspeed" means one of the following:

1. Indicated Airspeed—The speed shown on the aircraft airspeed indicator. This is the speed used in pilot/controller communications under the general term "airspeed." (Refer to FAR Part 1)
2. True Airspeed—The airspeed of an aircraft relative to undisturbed air. Used primarily in flight planning and en route portion of flight. When used in pilot/controller communications, it is referred to as "true airspeed" and not shortened to "airspeed."

AIRSTART— The starting of an aircraft engine while the aircraft is airborne, preceded by engine shutdown during training flights or by actual engine failure.

AIR TAXI— Used to describe a helicopter/VTOL aircraft movement conducted above the surface but normally not above 100 feet AGL. The aircraft may proceed either via hover taxi or flight at speeds more than 20 knots. The pilot is solely responsible for selecting a safe airspeed/altitude for the operation being conducted. (See Hover Taxi) (Refer to AIM)

AIR TRAFFIC— Aircraft operating in the air or on an airport surface, exclusive of loading ramps and parking areas.

ICAO—AIR TRAFFIC—All aircraft in flight or operating on the maneuvering area of an aerodrome.

AIR TRAFFIC CLEARANCE/ATC CLEARANCE— An authorization by air traffic control, for the purpose of preventing collision between known aircraft, for an aircraft to proceed under specified traffic conditions within controlled airspace. (See ATC Instructions)

ICAO—AIR TRAFFIC CONTROL CLEARANCE—Authorization for an aircraft to proceed under conditions specified by an air traffic control unit.

AIR TRAFFIC CONTROL/ATC— A service operated by appropriate authority to promote the safe, orderly and expeditious flow of air traffic.

ICAO—AIR TRAFFIC CONTROL SERVICE—A service provided for the purpose of:

1. Preventing collisions:
    a. Between aircraft, and
    b. On the maneuvering area between aircraft and obstructions, and
2. Expediting and maintaining an orderly flow of air traffic.

AIR TRAFFIC CONTROL COMMAND CENTER/ ATCCC— An Air Traffic Operations Service facility consisting of four operational units.

1. Central Flow Control Function/CFCF—Responsible for coordination and approval of all major intercenter flow control restrictions on a system basis in order to obtain maximum utilization of the airspace. (See Fuel Advisory Departure, Quota Flow Control)
2. Central Altitude Reservation Function/CARF—Responsible for coordinating, planning, and approving special user requirements under the Altitude Reservation (ALTRV) concept. (See Altitude Reservation)
3. Airport Reservation Office/ARO—Responsible for approving IFR flights at designated high density traffic airports (John F. Kennedy, LaGuardia, O'Hare, and Washington National) during specified hours. (Refer to FAR Part 93 and Airport/Facility Directory)

4. ATC Contingency Command Post—A facility which enables the FAA to manage the ATC system when significant portions of the system's capabilities have been lost or are threatened.

AIR TRAFFIC CONTROL SERVICE— (See Air Traffic Control)

AIR TRAFFIC CONTROL SPECIALIST/CONTROLLER— A person authorized to provide air traffic control service. (See Air Traffic Control, Flight Service Station)

ICAO—CONTROLLER—A person authorized to provide air traffic control services.

AIRWAY BEACON— Used to mark airway segments in remote mountain areas. The light flashes Morse Code to identify the beacon site. (Refer to AIM)

AIRWAY/FEDERAL AIRWAY— A control area or portion thereof established in the form of a corridor, the centerline of which is defined by radio navigational aids. (Refer to FAR Part 71, AIM)

ICAO-AIRWAY—A control area or portion thereof established in the form of corridor equipped with radio navigational aids.

ALERT AREA— (See Special Use Airspace)

ALERT NOTICE/ALNOT— A message sent by a flight service station (FSS) or an air route traffic control center (ARTCC) that requests an extensive communication search for overdue, unreported, or missing aircraft.

ALPHANUMERIC DISPLAY/DATA BLOCK— Letters and numerals used to show identification, altitude, beacon code, and other information concerning a target on a radar display. (See Automated Radar Terminal Systems, NAS Stage A)

ALTERNATE AIRPORT— An airport at which an aircraft may land if a landing at the intended airport becomes inadvisable.

ICAO-ALTERNATE AERODROME—An aerodrome specified in the flight plan to which a flight may proceed when it becomes inadvisable to land at the aerodrome of intended landing.

ALTIMETER SETTING— The barometric pressure reading used to adjust a pressure altimeter for variations in existing atmospheric pressure or to the standard altimeter setting (29.92). (Refer to FAR Part 91, AIM)

ALTITUDE— The height of a level, point, or object measured in feet Above Ground Level (AGL) or from Mean Sea Level (MSL). (See Flight Level)

1. MSL Altitude—Altitude expressed in feet measured from mean sea level.
2. AGL Altitude—Altitude expressed in feet measured above ground level.
3. Indicated Altitude—The altitude as shown by an altimeter. On a pressure or barometric altimeter it is altitude as shown uncorrected for instrument error and uncompensated for variation from standard atmospheric conditions.

ICAO-ALTITUDE—The vertical distance of a level, a point or an object considered as a point, measured from mean sea level.

ALTITUDE READOUT/AUTOMATIC ALTITUDE REPORT— An aircraft's altitude, transmitted via the Mode C transponder feature, that is visually displayed in 100-foot increments on a radar scope having readout capability. (See Automated Radar Terminal Systems, NAS Stage A, Alphanumeric Display) (Refer to AIM)

ALTITUDE RESERVATION/ALTRV— Airspace utilization under prescribed conditions normally employed for the mass movement of aircraft or other special user requirements which cannot otherwise be accomplished. ALTRVs are approved by the appropriate FAA facility. (See Air Traffic Control Command Center)

ALTITUDE RESTRICTION— An altitude or altitudes, stated in the order flown, which are to be maintained until reaching a specific point or time. Altitude restrictions may be issued by ATC due to traffic, terrain, or other airspace considerations.

ALTITUDE RESTRICTIONS ARE CANCELED— Adherence to previously imposed altitude restrictions is no longer required during a climb or descent.

APPROACH CLEARANCE— Authorization by ATC for a pilot to conduct an instrument approach. The type of instrument approach for which a clearance and other pertinent information is provided in the approach clearance when required. (See Instrument Approach Procedure, Cleared for Approach) (Refer to AIM and FAR Part 91)

APPROACH CONTROL FACILITY— A terminal ATC facility that provides approach control service in a terminal area. (See Approach Control Service, Radar Approach Control Facility.

APPROACH CONTROL SERVICE— Air traffic control service provided by an approach control facility for arriving and departing VFR/IFR aircraft and, on occasion, en route aircraft. At some airports not served by an approach control facility, the ARTCC provides limited approach control service. (Refer to AIM)

ICAO—APPROACH CONTROL SERVICE—Air traffic service for arriving or departing controlled flights.

APPROACH GATE— An imaginary point used within ATC as a basis for vectoring aircraft to the final approach course. The gate will be established along the final approach course 1 mile from the outer marker (or the fix used in lieu of the outer marker) on the side away from the airport for precision approaches and 1 mile from the final approach fix on the side away from the airport for nonprecision approaches. In either case when measured along the final approach course, the gate will be no closer than 5 miles from the landing threshold.

APPROACH LIGHT SYSTEM— (See Airport Lighting)

APPROACH SEQUENCE— The order in which aircraft are positioned while on approach or awaiting approach clearance. (See Landing Sequence)

ICAO—APPROACH SEQUENCE—The order in which two or more aircraft are cleared to approach to land at the aerodrome.

***APPROACH SPEED*—** The recommended speed contained in aircraft manuals used by pilots when making an approach to landing. This speed will vary for different segments of an approach as well as for aircraft weight and configuration.

APRON/RAMP— A defined area on an airport or heliport intended to accommodate aircraft for purposes of loading or unloading passengers or cargo, refueling, parking, or maintenance. With regard to seaplanes, a ramp is used for access to the apron from the water.

ICAO—APRON—A defined area, on a land aerodrome, intended to accommodate aircraft for purposes of loading or unloading passengers or cargo, refueling, parking or maintenance.

ARC— The track over the ground of an aircraft flying at a constant distance from a navigational aid by reference to distance measuring equipment (DME).

AREA NAVIGATION/RNAV— A method of navigation that permits aircraft operation on any desired course within the coverage of station-referenced navigation signals or within the limits of a self-contained system capability. Random Area Navigation routes are direct routes, based on area navigation capability, between waypoints defined in terms of latitude/longitude coordinates, degree/distance fixes, or offsets from published or established routes/airways at a specified distance and direction. The major types of equipment are:

1. VORTAC referenced or Course Line Computer (CLC) systems, which account for the greatest number of RNAV units in use. To function, the CLC must be within the service range of a VORTAC.
2. OMEGA/VLF, although two separate systems, can be considered as one operationally. A long-range navigation system based upon Very Low Frequency radio signals transmitted from a total of 17 stations worldwide.
3. Inertial (INS) systems, which are totally self-contained and require no information from external references. They provide aircraft position and navigation information in response to signals resulting from inertial effects on components within the system.
4. MLS Area Navigation (MLS/RNAV), which provides area navigation with reference to an MLS ground facility.

   Random Area Navigation routes are direct routes, based on area navigation capability, between waypoints defined in terms of latitude/longitude coordinates, degree/distance fixes, or offsets from published or established routes/airways at a specified distance and direction.
5. LORAN-C is a long-range radio navigation system that uses ground waves transmitted at low frequency to provide user position information at ranges of up to 600 to 1,200 nautical miles at both en route and approach altitudes. The useable signal coverage areas are determined by the signal-to-noise ratio, the envelope-to -cycle difference, and the geometric relationship between the positions of the user and the transmitting stations.

ICAO—AREA NAVIGATION/RNAV—A method of navigation which permits aircraft operation on any desired flight path within the coverage of station-referenced navigation aids or within the limits of the capability of self-contained aids or a combination of these.

ARMY AVIATION FLIGHT INFORMATION BULLETIN/USAFIB— A bulletin that provides air operation data covering Army, National Guard, and Army Reserve aviation activities.

ARRESTING SYSTEM— A safety device consisting of two major components, namely, engaging or catching devices and energy absorption devices for the purpose of arresting both tailhook and/or nontailhook-equipped aircraft. It is used to prevent aircraft from overrunning runways when the aircraft cannot be stopped after landing or during aborted takeoff. Arresting systems have various names; e.g., arresting gear, hook device, wire barrier cable. (See Abort) (Refer to AIM)

ARRIVAL TIME— The time an aircraft touches down on arrival.

ARTCC— (See Air Route Traffic Control Center)

ASR APPROACH— (See Surveillance Approach)

ATC ADVISES— Used to prefix a message of noncontrol information when it is relayed to an aircraft by other than an air traffic controller. (See Advisory)

ATC ASSIGNED AIRSPACE/ATCAA— Airspace of defined vertical/lateral limits, assigned by ATC, for the purpose of providing air traffic segregation between the specified activities being conducted within the assigned airspace and other IFR air traffic. (See Military Operations Area, Alert Area)

ATC CLEARANCE— (See Air Traffic Clearance)

ATC CLEARS— Used to prefix an ATC clearance when it is relayed to an aircraft by other than an air traffic controller.

ATC INSTRUCTIONS— Directives issued by air traffic control for the purpose of requiring a pilot to take specific actions; e.g., "Turn left heading two five zero," "Go around," "Clear the runway." (Refer to FAR Part 91)

ATCRBS— (See Radar)

ATC REQUESTS— Used to prefix an ATC request when it is relayed to an aircraft by other than an air traffic controller.

AUTOMATED RADAR TERMINAL SYSTEMS/ARTS— The generic term for the ultimate in functional capability afforded by several automation systems. Each differs in functional capabilities and equipment. ARTS plus a suffix roman numeral denotes a specific system. A following letter indicates a major modification to that system. In general, an ARTS displays for the terminal controller aircraft identification, flight plan data, other flight associated information; e.g., altitude, speed, and aircraft position symbols in conjunction with his radar presentation. Normal radar co-exists with the alphanumeric display. In addition to enhancing visualization of the air traffic situation, ARTS facilitate intra/inter-facility transfer and coordination of flight information. These capabilities are enabled by specially designed computers and subsystems tailored to the radar and communications equipments and operational requirements of each automated facility. Modular design permits adoption of improvements in computer software and electronic technologies as they become available while retaining the characteristics unique to each system.

1. ARTS II—A programmable nontracking, computer- aided display subsystem capable of modular expansion. ARTS II systems provide a level of automated air traffic control capability at terminals having low to medium activity. Flight identification and altitude may be associated with the display of secondary radar targets. The system has the capability of communicating with ARTCC's and other ATRS II, IIA, III, and IIIA facilities.

2. ARTS IIA—A programmable radar-tracking computer subsystem capable of modular expansion. The ARTS IIA detects, tracks, and predicts secondary radar targets. The targets are displayed by means of computer- generated symbols, ground speed, and flight plan data. Although it does not track primary radar targets, they are displayed coincident with the secondary radar as well as the symbols and alphanumerics. The system has the capability of communicating with ARTCC's and other ARTS II, IIA, III, and IIIA facilities.

3. ARTS III—The Beacon Tracking Level (BTL) of the modular programmable automated radar terminal system in use at medium to high activity terminals. ARTS III detects, tracks, and predicts secondary radar-derived aircraft targets. These are displayed by means of computer-generated symbols and alphanumeric characters depicting flight identification, aircraft altitude, ground speed, and flight plan data. Although it does not track primary targets, they are displayed coincident with the secondary radar as well as the symbols and alphanumerics. The system has the capability of communicating with ARTCC's and other ARTS III facilities.

4. ARTS IIIA—The Radar Tracking and Beacon Tracking Level (RT&BTL) of the modular, programmable automated radar terminal system. ARTS IIIA detects, tracks, and predicts primary as well as secondary radar-derived aircraft targets. This more sophisticated computer-driven system upgrades the existing ARTS III system by providing improved tracking, continuous data recording, and fail-soft capabilities.

AUTOMATIC ALTITUDE REPORTING— That function of a transponder which responds to Mode C interrogations by transmitting the aircraft's altitude in 100-foot increments.

AUTOMATIC CARRIER LANDING SYSTEM/ACLS— U.S. Navy final approach equipment consisting of precision tracking radar coupled to a computer data link to provide continuous information to the aircraft, monitoring capability to the pilot, and a backup approach system.

AUTOMATIC DIRECTION FINDER/ADF— An aircraft radio navigation system which senses and indicates the direction to a L/MF nondirectional radio beacon (NDB) ground transmitter. Direction is indicated to the pilot as a magnetic bearing or as a relative bearing to the longitudinal axis of the aircraft depending on the type of indicator installed in the aircraft. In certain applications, such as military, ADF operations may be based on airborne and ground transmitters in the VHF/UHF frequency spectrum. (See Bearing, Nondirectional Beacon)

AUTOMATIC TERMINAL INFORMATION SERVICE/ATIS— The continuous broadcast of recorded noncontrol information in selected terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information; e.g.,"Los Angeles information Alfa. One three zero zero Coordinated Universal Time. Weather, measured ceiling two thousand overcast, visibility three, haze, smoke, temperature seven one, dew point five seven, wind two five zero at five, altimeter two niner niner six. I-L-S Runway Two Five Left approach in use, Runway Two Five Right closed, advise you have Alfa." (Refer to AIM)

ICAO—AUTOMATIC TERMINAL INFORMATION SERVICE—The provision of current, routine information to arriving and departing aircraft by means of continuous and repetitive broadcasts throughout the day or a specified portion of the day.

AUTOROTATION— A rotorcraft flight condition in which the lifting rotor is driven entirely by action of the air when the rotorcraft is in motion.

1. Autorotative Landing/Touchdown Autorotation—Used by a pilot to indicate that he will be landing without applying power to the rotor.

2. Low Level Autorotation—Commences at an altitude well below the traffic pattern, usually below 100 feet AGL and is used primarily for tactical military training.

3. 180 degrees Autorotation—Initiated from a downwind heading and is commenced well inside the normal traffic pattern. "Go around" may not be possible during the latter part of this maneuver.

AVIATION WEATHER SERVICE— A service provided by the National Weather Service (NWS) and FAA which collects and disseminates pertinent weather information for pilots, aircraft operators, and ATC. Available aviation weather reports and forecasts are displayed at each NWS office and FAA FSS. (See En Route Flight Advisory Service, Transcribed Weather Broadcast, Weather Advisory, Pilots Automatic Telephone Weather Answering Service) (Refer to AIM)

AZIMUTH, MLS—A magnetic bearing extending from an MLS navigation facility. Note: azimuth bearings are described as magnetic and are referred to as "azimuth" in radio telephone communications.

BASE LEG— (See Traffic Pattern)

BEACON— (See Radar, Nondirectional Beacon, Marker Beacon, Airport Rotating Beacon, Aeronautical Beacon, Airway Beacon))

BEARING— The horizontal direction to or from any point, usually measured clockwise from true north, magnetic north, or some other reference point through 360 degrees. (See Nondirectional Beacon)

BELOW MINIMUMS— Weather conditions below the minimums prescribed by regulation for the particular action involved; e.g., landing minimums, takeoff minimums.

BLAST FENCE— A barrier that is used to divert or dissipate jet or propeller blast.

BLIND SPEED— The rate of departure or closing of a target relative to the radar antenna at which cancellation of the primary radar target by moving target indicator (MTI) circuits in the radar equipment causes a reduction or complete loss of signal.

*ICAO—BLIND VELOCITY—*The radial velocity of a moving target such that the target is not seen on primary radars fitted with certain forms of fixed echo suppression.

BLIND SPOT/BLIND ZONE— An area from which radio transmissions and/or radar echoes cannot be received. The term is also used to describe portions of the airport not visible from the control tower.

BOUNDARY LIGHTS— (See Airport Lighting)

BRAKING ACTION (GOOD, FAIR, POOR, OR NIL)— A report of conditions on the airport movement area providing a pilot with a degree/quality of braking that he might expect. Braking action is reported in terms of good, fair, poor, or nil. (See Runway Condition Reading)

BRAKING ACTION ADVISORIES— When tower controllers have received runway braking action reports which include the terms "poor" or "nil," or whenever weather conditions are conducive to deteriorating or rapidly changing runway braking conditions, the tower will include on the ATIS broadcast the statement, "BRAKING ACTION ADVISORIES ARE IN EFFECT." During the time Braking Action Advisories are in effect, ATC will issue the latest braking action report for the runway in use to each arriving and departing aircraft. Pilots should be prepared for deteriorating braking conditions and should request current runway condition information if not volunteered by controllers. Pilots should also be prepared to provide a descriptive runway condition report to controllers after landing.

BROADCAST— Transmission of information for which an acknowledgement is not expected.

*ICAO—BROADCAST—*A transmission of information relating to air navigation that is not addressed to a specific station or stations.

CALL UP— Initial voice contact between a facility and an aircraft, using the identification of the unit being called and the unit initiating the call. (Refer to AIM)

CARDINAL ALTITUDES OR FLIGHT LEVELS— "Odd" or "Even" thousand-foot altitudes or flight levels; e.g., 5,000, 6,000, 7,000, FL 250, FL 260, FL 270. (See Altitude, Flight Levels)

CEILING— The heights above the earth's surface of the lowest layer of clouds or obscuring phenomena that is reported as "broken," "overcast," or "obscuration," and not classified as "thin" or "partial".

*ICAO—CEILING—*The height above the ground or water of the base of the lowest layer of cloud below 6,000 meters (20,000 feet) covering more than half the sky.

CELESTIAL NAVIGATION— The determination of geographical position by reference to celestial bodies. Normally used in aviation as a secondary means of position determination.

CENTER— (See Air Route Traffic Control Center)

CENTER'S AREA— The specified airspace within which an air route traffic control center (ARTCC) provides air traffic control and advisory service. (See Air Route Traffic Control Center) (Refer to AIM)

CENTER WEATHER ADVISORY/CWA— An unscheduled weather advisory issued by Center Weather Service Unit meteorologists for ATC use to alert pilots of existing or anticipated adverse weather conditions within the next 2 hours. A CWA may modify or redefine a SIGMET. (See SIGMET, Convective SIGMET, and AIRMET) (Refer to AIM)

CHAFF— Thin, narrow metallic reflectors of various lengths and frequency responses, used to reflect radar energy. These reflectors when dropped from aircraft and allowed to drift downward result in large targets on the radar display.

CHARTED VFR FLYWAYS— Charted VFR Flyways are flight paths recommended for use to bypass areas heavily traversed by large turbine-powered aircraft. Pilot compliance with recommended flyways and associated altitudes is strictly voluntary. VFR Flyway Planning charts are published on the back of existing VFR Terminal Area charts.

CHARTED VISUAL FLIGHT PROCEDURE (CVFP) APPROACH— An approach wherein a radar-controlled aircraft on an IFR flight plan, operating in VFR conditions and having an ATC authorization, may proceed to the airport of intended landing via visual landmarks and altitudes depicted on a charted visual flight procedure.

CHASE/CHASE AIRCRAFT— An aircraft flown in proximity to another aircraft normally to observe its performance during training or testing.

CIRCLE-TO-LAND MANEUVER/CIRCLING MANEUVER— A maneuver initiated by the pilot to align the aircraft with a runway for landing when a straight-in landing from an instrument approach is not possible or is not desirable. This maneuver is made only after ATC authorization has been obtained and the pilot has established required visual reference to the airport (See Circle to Runway, Landing Minimums) (Refer to AIM)

CIRCLE TO RUNWAY (RUNWAY NUMBERED)— Used by ATC to inform the pilot that he must circle to land because the runway in use is other than the runway aligned with the instrument approach procedure. When the direction of the circling maneuver in relation to the airport/runway is required, the controller will state the direction (eight cardinal compass points) and specify a left or right downwind or base leg as appropriate; e.g., "Cleared VOR Runway Three Six Approach circle to Runway Two Two," or "Circle northwest of the airport for a right downwind to Runway Two Two." (See Circle-to-Land Maneuver, Landing Minimums) (Refer to AIM)

CIRCLING APPROACH— (See Circle-to-Land Maneuver)

CIRCLING MINIMA— (See Landing Minimums)

CLEAR-AIR TURBULENCE/CAT— Turbulence encountered in air where no clouds are present. This term is commonly applied to high-level turbulence associated with wind shear. CAT is often encountered in the vicinity of the jet stream. (See Wind Shear, Jet Stream)

CLEARANCE— (See Air Traffic Clearance)

CLEARANCE LIMIT— The fix, point, or location to which an aircraft is cleared when issued an air traffic clearance.

*ICAO—CLEARANCE LIMIT—*The point of which an aircraft is granted an air traffic control clearance.

CLEARANCE VOID IF NOT OFF BY (TIME)— Used by ATC to advise an aircraft that the departure clearance is automatically cancelled if takeoff is not made prior to a specified time. The pilot must obtain a new clearance or cancel his IFR flight plan if not off by the specified time.

ICAO—CLEARANCE VOID TIME— A time specified by an air traffic control unit at which a clearance ceases to be valid unless the aircraft concerned has already taken action to comply therewith.

CLEARED AS FILED— Means the aircraft is cleared to proceed in accordance with the route of flight filed in the flight plan. This clearance does not include the altitude, SID, or SID Transition. (See Request Full Route Clearance) (Refer to AIM)

CLEARED FOR (Type Of) APPROACH— ATC authorization for an aircraft to execute a specific instrument approach procedure to an airport; e.g., "Cleared for ILS Runway Three Six Approach." (See Instrument Approach Procedure, Approach Clearance) (Refer to AIM, FAR Part 91)

CLEARED FOR APPROACH— ATC authorization for an aircraft to execute any standard or special instrument approach procedure for that airport. Normally, an aircraft will be cleared for a specific instrument approach procedure. (See Instrument Approach Procedure, Cleared for (Type of) Approach) (Refer to AIM, FAR Part 91)

CLEARED FOR TAKEOFF— ATC authorization for an aircraft to depart. It is predicated on known traffic and known physical airport conditions.

CLEARED FOR THE OPTION— ATC authorization for an aircraft to make a touch-and-go, low approach, missed approach, stop and go, or full stop landing at the discretion of the pilot. It is normally used in training so that an instructor can evaluate a student's performance under changing situations. (See Option Approach) (Refer to AIM)

CLEARED THROUGH— ATC authorization for an aircraft to make intermediate stops at specified airports without refiling a flight plan while en route to the clearance limit.

CLEARED TO LAND— ATC authorization for an aircraft to land. It is predicated on known traffic and known physical airport conditions.

CLEARWAY— An area beyond the takeoff runway under the control of airport authorities within which terrain or fixed obstacles may not extend above specified limits. These areas may be required for certain turbine-powered operations and the size and upward slope of the clearway will differ depending on when the aircraft was certificated. (Refer to FAR Part 1)

CLIMBOUT— That portion of flight operation between takeoff and the initial cruising altitude. in the event of two-way communication failure. It also provides altitude

CLIMB TO VFR— ATC authorization for an aircraft to climb to VFR conditions within a control zone when the only weather limitation is restricted visibility. The aircraft must remain clear of clouds while climbing to VFR. (See Special VFR) (Refer to AIM)

CLOSED RUNWAY— A runway that is unusable for aircraft operations. Only the airport management/military operations office can close a runway.

CLOSED TRAFFIC— Successive operations involving takeoffs and landings or low approaches where the aircraft does not exit the traffic pattern.

CLUTTER— In radar operations, clutter refers to the reception and visual display of radar returns caused by precipitation, chaff, terrain, numerous aircraft targets, or other phenomena. Such returns may limit or preclude ATC from providing services based on radar. (See Ground Clutter, Chaff, Precipitation, Target)

*ICAO—Radar Clutter—*The visual indication on a radar display of unwanted signals.

COASTAL FIX— A navigation aid or intersection where an aircraft transitions between the domestic route structure and the oceanic route structure.

CODES/TRANSPONDER CODES— The number assigned to a particular multiple pulse reply signal transmitted by a transponder. (See Discrete Code)

COMBINED CENTER-RAPCON/CERAP— An air traffic facility which combines the functions of an

ARTCC and a radar approach control facility. (See Air Route Traffic Control Center/ARTCC, Radar Approach Control Facility)

COMMON ROUTE/COMMON PORTION— That segment of a North American Route between the inland navigation facility and the coastal fix.

COMMON TRAFFIC ADVISORY FREQUENCY/CTAF— A frequency designed for the purpose of carrying out airport advisory practices while operating to or from an uncontrolled airport. The CTAF may be a UNICOM, Multicom, FSS, or tower frequency and is identified in appropriate aeronautical publications. (Refer to AC—90-42C)

COMPASS LOCATOR— A low power, low or medium frequency (L/MF) radio beacon installed at the site of the outer or middle marker of an instrument landing system (ILS). It can be used for navigation at distances of approximately 15 miles or as authorized in the approach procedure.

1. Outer Compass Locator/LOM—A compass locator installed at the site of the outer marker of an instrument landing system. (See Outer Marker)
2. Middle Compass Locator/LMM—A compass locator installed at the site of the middle marker of an instrument landing system. (See Middle Marker)

ICAO—LOCATOR—An LM/MF NDB used as an aid to final approach.

COMPASS ROSE— A circle, graduated in degrees, printed on some charts or marked on the ground at an airport. It is used as a reference to either true or magnetic direction.

COMPOSITE FLIGHT PLAN— A flight plan which specifies VFR operation for one portion of flight and IFR for another portion. It is used primarily in military operations. (Refer to AIM)

COMPOSITE ROUTE SYSTEM— An organized oceanic route structure, incorporating reduced lateral spacing between routes, in which composite separation is authorized.

COMPOSITE SEPARATION— A method of separating aircraft in a composite route system where, by management of route and altitude assignments, a combination of half the lateral minimum specified for the area concerned and half the vertical minimum is applied.

COMPULSORY REPORTING POINTS— Reporting points which must be reported to ATC. They are designated on aeronautical charts by solid triangles or filed in a flight plan as fixes selected to define direct routes. These points are geographical locations which are defined by navigation aids/fixes. Pilots should discontinue position reporting over compulsory reporting points when informed by ATC that their aircraft is in "radar contact."

CONFLICT ALERT— A function of certain air traffic control automated systems designed to alert radar controllers to existing or pending situations recognized by the program parameters that require his immediate attention/action.

CONFLICT RESOLUTION— The resolution of potential conflictions between IFR aircraft and VFR aircraft that are radar identified and in communication with ATC by ensuring that radar targets do not touch. Pertinent traffic advisories shall be issued when this procedure is applied. Note: This separation procedure will not be provided utilizing fully digitized radar systems. (See Controlled Airspace—Airport Radar Service Area / ARSA, Outer Area)

CONSOLAN— A low frequency, long-distance NAVAID used principally for transoceanic navigations.

CONTACT—

1. Establish communication with (followed by the name of the facility and, if appropriate, the frequency to be used).
2. A flight condition wherein the pilot ascertains the attitude of his aircraft and navigates by visual reference to the surface. (See Contact Approach, Radar Contact)

CONTACT APPROACH— An approach wherein an aircraft on an IFR flight plan, having an air traffic control authorization, operating clear of clouds with at least 1 mile flight visibility and a reasonable expectation of continuing to the destination airport in those conditions, may deviate from the instrument approach procedure and proceed to the destination airport by visual reference to the surface. This approach will only be authorized when requested by the pilot and the reported ground visibility at the destination airport is at least 1 statute mile. (Refer to AIM)

CONTERMINOUS U.S.— The 48 adjoining States and the District of Columbia.

CONTINENTAL CONTROL AREA— (See Controlled Airspace)

CONTINENTAL UNITED STATES— The 49 States located on the continent of North America and the District of Columbia.

CONTROL AREA— (See Controlled Airspace)

CONTROLLED AIRSPACE— Airspace designated as a control zone, airport radar service area, terminal control area, transition area, control area, continental control area, and positive control area within which some or all aircraft may be subject to air traffic control. (Refer to AIM, FAR Part 71)

ICAO—CONTROLLED AIRSPACE—Airspace of defined dimensions within which air traffic control service is provided to controlled flights.

Types of U.S. Controlled Airspace:

1. Control Zone—Controlled airspace which extends upward from the surface of the earth and terminates at the base of the continental control area. Control zones that do not underlie the continental control area have no upper limit. A control zone may include one or more airports and is normally a circular area with a radius of 5 statute miles and any extensions necessary to include instrument approach and departure paths.

ICAO—Control Zone—A controlled airspace extending upwards from the surface of the earth to a specified upper limit.

2. Airport Radar Service Area / ARSA—Regulatory airspace surrounding designated airports wherein ATC provides radar vectoring and sequencing on a full-time basis for all IFR and VFR aircraft. The service provided in an ARSA is called ARSA service which includes: IFR/IFR—standard IFR separation; IFR/VFR—traffic advisories and conflict resolution; and VFR/VFR—traffic advisories and, as appropriate, safety alerts. The AIM contains an explanation of ARSA. The ARSA's are depicted on VFR aeronautical charts. (See Conflict Resolution, Outer Area) (Refer to AIM, Airport/Facility Directory, FAR Part 91)

3. Terminal Control Area/TCA—Controlled airspace extending upward from the surface or higher to specified altitudes, within which all aircraft are subject to operating rules and pilot and equipment requirements specified in FAR Part 91. TCA's are depicted on Sectional, World Aeronautical, En Route Low Altitude, DOD FLIP, and TCA charts. (Refer to FAR Part 91, AIM)

ICAO—Terminal Control Area—A control area normally established at the confluence of ATS routes in the vicinity of one or more major aerodromes.

4. Transition Area—Controlled airspace extending upward from 700 feet or more above the surface of the earth when designated in conjunction with an airport for which an approved instrument approach procedure has been prescribed; or from 1,200 feet or more above the surface of the earth when designated in conjunction with airway route structures or segments. Unless otherwise specified, transition areas terminate at the base of the overlying controlled airspace. Transition areas are designed to contain IFR operations in controlled airspace during portions of the terminal operation and while transiting between the terminal and en route environment.

5. Control Area—Airspace designated as Colored Federal airways, VOR Federal airways, control areas associated with jet routes outside the continental control area (FAR 71.161), additional control areas (FAR 71.163), control area extensions (FAR 71.165), and area low routes. Control areas do not include the continental control area, but unless otherwise designated, they do include the airspace between a segment of a main VOR Federal airway and its associated alternate segments with the vertical extent of the area corresponding to the vertical extent of the related segment of the main airway. The vertical extent of the various categories of airspace contained in control areas is defined in FAR Part 71.

ICAO—Control Area—A controlled airspace extending upward from a specified limit above the earth.

6. Continental Control Area—The airspace of the 48 contiguous States, the District of Columbia and Alaska, excluding the Alaska peninsula west of Long. 160° 00′ 00″W, at and above 14,500 feet MSL, but does not include:
   a. The airspace less than 1,500 feet above the surface of the earth; or
   b. Prohibited and restricted areas, other than the restricted areas listed in FAR Part 71.

7. Positive Control Area/PCA—Airspace designated in FAR, Part 71 within which there is positive control of aircraft. Flight in PCA is normally conducted under instrument flight rules. PCA is designated throughout most of the conterminous United States and its vertical extent is from 18,000 feet MSL to and including flight level 600. In Alaska PCA does not include the airspace less than 1,500 feet above the surface of the earth nor the airspace over the Alaska Peninsula west of longitude 160 degrees West. Rules for operating in PCA are found in FARs 91.97 and 91.24.

CONTROLLED DEPARTURE TIME (CDT) PROGRAMS— These programs are the flow control process whereby aircraft are held on the ground at the departure airport when delays are projected to occur in either the en route system or the terminal of intended landing. The purpose of these programs is to reduce congestion in the air traffic system or to limit the duration of airborne holding in the arrival center or terminal area. A CDT is a specific departure slot shown on the flight plan as an expected departure clearance time (EDCT).

CONTROLLER— (See Air Traffic Control Specialist)

CONTROL SECTOR— An airspace area of defined horizontal and vertical dimensions for which a controller or group of controllers has air traffic control responsibility, normally within an air route traffic control center or an approach control facility. Sectors are established based on predominant traffic flows, altitude strata, and controller workload. Pilot-communications during operations within a sector are normally maintained on discrete frequencies assigned to the sector. (See Discrete Frequency)

CONTROL SLASH— A radar beacon slash representing the actual position of the associated aircraft. Normally, the control slash is the one closest to the interrogating radar beacon site. When ARTCC radar is operating in narrowband (digitized) mode, the control slash is converted to a target symbol.

CONTROL ZONE— (See Controlled Airspace)

***CONVECTIVE SIGMET* /WST/CONVECTIVE SIGNIFICANT METEOROLOGICAL INFORMATION—** A weather advisory concerning convective weather significant to the safety of all aircraft. Convective SIGMET's are issued for tornadoes, lines of thunderstorms, embedded thunderstorms of any intensity level, areas of thunderstorms greater than or equal to VIP level 4 with an areal coverage of 4/10 (40%) or more, and hail 3/4 inch or greater. (See SIGMET, CWA, and AIRMET) (Refer to AIM)

COORDINATES— The intersection of lines of reference, usually expressed in degrees/minutes/seconds of latitude and longitude, used to determine position or location.

COORDINATION FIX— The fix in relation to which facilities will handoff, transfer control of an aircraft, or coordinate flight progress data. For terminal facilities, it may also serve as a clearance for arriving aircraft.

CORRECTION— An error has been made in the transmission and the correct version follows.

COURSE—

1. The intended direction of flight in the horizontal plane measured in degrees from north.
2. The ILS localizer signal pattern usually specified as the front course or the back course.
3. The intended track along a straight, curved, or segmented MLS path.

(See Bearing, Radial, Instrument Landing System, Microwave Landing System)

CRITICAL ENGINE— The engine which, upon failure, would most adversely affect the performance or handling qualities of an aircraft.

CROSS (FIX) AT (ALTITUDE)— Used by ATC when a specific altitude restriction at a specified fix is required.

CROSS (FIX) AT OR ABOVE (ALTITUDE)— Used by ATC when an altitude restriction at a specified fix is required. It does not prohibit the aircraft from crossing the fix at a higher altitude than specified; however, the higher altitude may not be one that will violate a succeeding altitude restriction or altitude assignment. (See Altitude Assignment, Altitude Restriction.) (Refer to AIM)

CROSS (FIX) AT OR BELOW (ALTITUDE)— Used by ATC when a maximum crossing altitude at a specific fix is required. It does not prohibit the aircraft from crossing the fix at a lower altitude; however, it must be at or above the minimum IFR altitude. (See Minimum IFR Altitude, Altitude Restriction) (Refer to FAR Part 91)

CROSSWIND—

1. When used concerning the traffic pattern, the word means "crosswind leg." (See Traffic Pattern)
2. When used concerning wind conditions, the word means a wind not parallel to the runway or the path of an aircraft. (See Crosswind Component)

CROSSWIND COMPONENT— The wind component measured in knots at 90 degrees to the longitudinal axis of the runway.

CRUISE— Used in an ATC clearance to authorize a pilot to conduct flight at any altitude from the minimum IFR altitude up to and including the altitude specified in the clearance. The pilot may level off at any intermediate altitude within this block of airspace. Climb/descent within the block is to be made at the discretion of the pilot. However, once the pilot starts descent and verbally reports leaving an altitude in the block, he may not return to that altitude without additional ATC clearance. Further, it is approval for the pilot to proceed to and make an approach at destination airport and can be used in conjunction with:

1. An airport clearance limit at locations with a standard/special instrument approach procedure. The FAR's require that if an instrument letdown to an airport is necessary, the pilot shall make the letdown in accordance with a standard/special instrument approach procedure for that airport, or
2. An airport clearance limit at locations that are within/below/outside controlled airspace and without a standard/special instrument approach procedure. Such a clearance is NOT AUTHORIZATION for the pilot to descend under IFR conditions below the applicable minimum IFR altitude nor does it imply that ATC is exercising control over aircraft in uncontrolled airspace; however, it provides a means for the aircraft to proceed to destination airport, descend, and land in accordance with applicable FAR's governing VFR flight operations. Also, this provides search and rescue protection until such time as the IFR flight plan is closed. (See Instrument Approach Procedure)

CRUISING ALTITUDE/LEVEL— An altitude or flight level maintained during en route level flight. This is a constant altitude and should not be confused with a cruise clearance. (See Altitude)

*ICAO—CRUISING LEVEL—*A level maintained during a significant portion of a flight.

DECISION HEIGHT/DH— With respect to the operation of aircraft, means the height at which a decision must be made during an ILS, MLS, or PAR instrument approach to either continue the approach or to execute a missed approach.

*ICAO—DECISION HEIGHT—*A specified height at which a missed approach must be initiated if the required visual reference to continue the approach to land has not been established.

DECODER— The device used to decipher signals received from ATCRBS transponders to effect their display as select codes. (See Codes, Radar)

DEFENSE VISUAL FLIGHT RULES/DVFR— Rules applicable to flights within an ADIZ conducted under the visual flight rules in FAR, Part 91. (See Air Defense Identification Zone) (Refer to FAR, Part 99)

DELAY INDEFINITE (REASON IF KNOWN) EXPECT FURTHER CLEARANCE (TIME)— Used by ATC to inform a pilot when an accurate estimate of the delay time and the reason for the delay cannot immediately be determined; e.g., a disabled aircraft on the runway, terminal or center area saturation, weather below landing minimums, etc. (See Expect Further Clearance)

DEPARTURE CONTROL— A function of an approach control facility providing air traffic control service for departing IFR and, under certain conditions, VFR aircraft. (See Approach Control) (Refer to AIM)

DEPARTURE TIME— The time an aircraft becomes airborne.

DEVIATIONS—

1. A departure from a current clearance, such as an off course maneuver to avoid weather or turbulence.
2. Where specifically authorized in the FAR's and requested by the pilot, ATC may permit pilots to deviate from certain regulations. (Refer to AIM)

DF APPROACH PROCEDURE— Used under emergency conditions where another instrument approach procedure cannot be executed. DF guidance for an instrument approach is given by ATC facilities with DF capability. (See DF Guidance, Direction Finder) (Refer to AIM)

DF FIX— The geographical location of an aircraft obtained by one or more direction finders. (See Direction Finder)

DF GUIDANCE/DF STEER— Headings provided to aircraft by facilities equipped with direction finding equipment. These headings, if followed, will lead the aircraft to a predetermined point such as the DF station or an airport. DF guidance is given to aircraft in distress or to other aircraft which request the service. Practice DF guidance is provided when workload permits. (See Direction Finder, DF Fix) (Refer to AIM)

***DIRECT*—** Straight line flight between two navigational aids, fixes, points, or any combination thereof. When used by pilots in describing off-airway routes, points defining direct route segments become compulsory reporting points unless the aircraft is under radar contact.

DIRECT ALTITUDE AND IDENTITY READOUT/DAIR— The DAIR System is a modification to the AN/TPX-42 Interrogator System. The Navy has two adaptations of the DAIR System– Carrier Air Traffic Control Direct Altitude and Identification Readout System for Aircraft Carriers and Radar Air Traffic Control Facility Direct Altitude and Identity Readout System for land-based terminal operations. The DAIR detects, tracks, and predicts secondary radar aircraft targets. Targets are displayed by means of computer-generated symbols and alphanumeric characters depicting flight identification, altitude, ground speed, and flight plan data. The DAIR System is capable of interfacing with ARTCC's.

DIRECTION FINDER/DF/UDF/VDF/UVDF— A radio receiver equipped with a directional sensing antenna used to take bearings on a radio transmitter. Specialized radio direction finders are used in aircraft as air navigation aids. Others are ground-based, primarily to obtain a "fix" on a pilot requesting orientation assistance or to locate downed aircraft. A location "fix" is established by the intersection of two or more bearing lines plotted on a navigational chart using either two separately located Direction Finders to obtain a fix on an aircraft or by a pilot plotting the bearing indications of his DF on two separately located ground-based transmitters, both of which can be identified on his chart. UDF's receive signals in the ultra high frequency radio broadcast band; VDF's in the very high frequency band; and UVDF's in both bands. ATC provides DF service at those air traffic control towers and flight service stations listed in the Airport/Facility Directory and the DOD FLIP IFR En Route Supplement. (See DF Guidance, DF Fix)

DISCRETE CODE/DISCRETE BEACON CODE— As used in the Air Traffic Control Radar Beacon System (ATCRBS), any one of the 4096 selectable Mode 3/A aircraft transponder codes except those ending in zero zero; e.g., discrete codes: 0010, 1201, 2317, 7777; non-discrete codes: 0100, 1200, 7700. Non-discrete codes are normally reserved for radar facilities that are not equipped with discrete decoding capability and for other purposes such as emergencies (7700), VFR aircraft (1200), etc. (See Radar) (Refer to AIM)

DISCRETE FREQUENCY— A separate radio frequency for use in direct pilot-controller communications in air traffic control which reduces frequency congestion by controlling the number of aircraft operating on a particular frequency at one time. Discrete frequencies are normally designated for each control sector in en route/terminal ATC facilities. Discrete frequencies are listed in the Airport/Facility Directory and the DOD FLIP IFR En Route Supplement. (See Control Sector)

DISPLACED THRESHOLD— A threshold that is located at a point on the runway other than the designated beginning of the runway. (See Threshold) (Refer to AIM)

DISTANCE MEASURING EQUIPMENT/DME— Equipment (airborne and ground) used to measure, in nautical miles, the slant range distance of an aircraft from the DME navigational aid. (See TACAN, VORTAC, Microwave Landing System)

DISTRESS— A condition of being threatened by serious and/or imminent, danger, and of requiring immediate assistance.

DIVERSE VECTOR AREA/DVA— In a radar environment, that area in which a prescribed departure route is not required as the only suitable route to avoid obstacles. The area in which random radar vectors below the MVA/MIA, established in accordance with the TERPS criteria for diverse departures obstacles and terrain avoidance, may be issued to departing aircraft.

DME FIX— A geographical position determined by reference to a navigational aid which provides distance and azimuth information. It is defined by a specific distance in nautical miles and a radial, azimuth, or course (i.e., localizer) in degrees magnetic from that aid. (See Distance Measuring Equipment/DME, Fix, Microwave Landing System)

DME SEPARATION— Spacing of aircraft in terms of distances (nautical miles) determined by reference to distance measuring equipment (DME). (See Distance Measuring Equipment)

DOD FLIP— Department of Defense Flight Information Publications used for flight planning, en route, and terminal operations. FLIP is produced by the Defense Mapping Agency for world-wide use. United States Government Flight Information Publications (en route charts and instrument approach procedure charts) are incorporated in DOD FLIP for use in the National Airspace System (NAS).

DOWNWIND LEG— (See Traffic Pattern)

DRAG CHUTE— A parachute device installed on certain aircraft which is deployed on landing roll to assist in deceleration of the aircraft.

EMERGENCY— **ADISTRESS** or **URGENCY** condition.

EMERGENCY LOCATOR TRANSMITTER/ELT— A radio transmitter attached to the aircraft structure which operates from its own power source on 121.5 MHz and 243.0 MHz. It aids in locating downed aircraft by radiating a downward sweeping audio tone, 2-4 times per second. It is designed to function without human action after an accident. (Refer to FAR, Part 91, AIM)

EMERGENCY SAFE ALTITUDE— (See Minimum Safe Altitude)

E-MSAW— (See En Route Minimum Safe Altitude Warning)

EN ROUTE AIR TRAFFIC CONTROL SERVICES— Air traffic control service provided aircraft on IFR flight plans, generally by centers, when these aircraft are operating between departure and destination terminal areas. When equipment, capabilities, and controller workload permit, certain advisory/assistance services may be provided to VFR aircraft. (See NAS Stage A, Air Route Traffic Control Center) (Refer to AIM)

EN ROUTE AUTOMATED RADAR TRACKING SYSTEM/EARTS— An automated radar and radar beacon tracking system. Its functional capabilities and design are essentially the same as the terminal ARTS IIIA system except for the EARTS capability of employing both short-range (ASR) and long-range (ARSR) radars, use of full digital radar displays, and fail-safe design. (See Automated Radar Terminal Systems/ARTS)

EN ROUTE CHARTS— (See Aeronautical Charts)

EN ROUTE DESCENT— Descent from the en route cruising altitude which takes place along the route of flight.

EN ROUTE FLIGHT ADVISORY SERVICE/FLIGHT WATCH— A service specifically designed to provide, upon pilot request, timely weather information pertinent to his type of flight, intended route of flight, and altitude. The FSS's providing this service are listed in the Airport/Facility Directory. (Refer to AIM)

EN ROUTE MINIMUM SAFE ALTITUDE WARNING/E-MSAW— A function of the NAS Stage A en route computer that aids the controller by alerting him when a tracked aircraft is below or predicted by the computer to go below a predetermined minimum IFR altitude (MIA).

ICAO-ESTIMATED ELAPSED TIME/EET--The estimated time required to proceed from one significant point to another (for use in international flight planning). (See Total Estimated Elapsed Time)

ICAO-ESTIMATED OFF-BLOCK TIME--The estimated time at which the aircraft will commence movement associated with departure (for use in international flight planning).

EXECUTE MISSED APPROACH— Instructions issued to a pilot making an instrument approach which means continue inbound to the missed approach point and execute the missed approach procedure as described on the Instrument Approach Procedure Chart or as previously assigned by ATC. The pilot may climb immediately to the altitude specified in the missed approach procedure upon making a missed approach. No turns should be initiated prior to reaching the missed approach point. When conducting an ASR or PAR approach, execute the assigned missed approach procedure immediately upon receiving instructions to "execute missed approach." (Refer to AIM)

EXPECT (ALTITUDE) AT (TIME) or (FIX)— Used under certain conditions to provide a pilot with an altitude to be used in the event of two-way communications failure. It also provides altitude information to assist the pilot in planning. (Refer to AIM)

EXPECTED DEPARTURE CLEARANCE TIME/EDCT— The runway release time assigned to an aircraft in a controlled departure time program and shown on the flight progress strip as an EDCT.

EXPECT FURTHER CLEARANCE (TIME)/EFC— The time a pilot can expect to receive clearance beyond a clearance limit.

EXPECT FURTHER CLEARANCE VIA (AIRWAYS, ROUTES OR FIXES)— Used to inform a pilot of the routing he can expect if any part of the route beyond a short range clearance limit differs from that filed.

EXPEDITE— Used by ATC when prompt compliance is required to avoid the development of an imminent situation.

FAST FILE— A system whereby a pilot files a flight plan via telephone that is tape recorded and then transcribed for transmission to the appropriate air traffic facility. Locations having a fast file capability are contained in the Airport/Facility Directory. (Refer to AIM)

FEATHERED PROPELLER— A propeller whose blades have been rotated so that the leading and trailing edges are nearly parallel with the aircraft flight path to stop or minimize drag and engine rotation. Normally used to indicate shutdown of a reciprocating or turboprop engine due to malfunction.

FEEDER ROUTE— A route depicted on instrument approach procedure charts to designate routes for aircraft to proceed from the en route structure to the initial approach fix (IAF). (See Instrument Approach Procedure)

FERRY FLIGHT— A flight for the purpose of:

1. Returning an aircraft to base,
2. Delivering an aircraft from one location to another.
3. Moving an aircraft to and from a maintenance base.

Ferry flights, under certain conditions, may be conducted under terms of a special flight permit.

FILED— Normally used in conjunction with flight plans, meaning a flight plan has been submitted to ATC.

FILED EN ROUTE DELAY— Any of the following preplanned delays at points/areas along the route of flight which require special flight plan filing and handling techniques.

1. Terminal Area Delay—A delay within a terminal area for touch-and-go, low approach, or other terminal area activity.
2. Special Use Airspace Delay—A delay within a Military Operating Area, Restricted Area, Warning Area, or ATC Assigned Airspace.
3. Aerial Refueling Delay—A delay within an Aerial Refueling Track or Anchor.

FINAL— Commonly used to mean that an aircraft is on the final approach course or is aligned with a landing area. (See Final Approach Course, Final Approach—IFR, Traffic Pattern, Segments of an Instrument Approach Procedure)

FINAL APPROACH COURSE— A published MLS course, a straight line extension of a localizer, a final approach radial/bearing, or a runway centerline all without regard to distance. (See Final Approach—IFR, Traffic Pattern)

FINAL APPROACH FIX/FAF— The fix from which the final approach (IFR) to an airport is executed and which identifies the beginning of the final approach segment. It is designated on Government charts by the Maltese Cross symbol for nonprecision approaches and the lightning bolt symbol for precision approaches; or when ATC directs a lower-than-published Glideslope/path Intercept Altitude, it is the resultant actual point of the glideslope/path intercept. (See Final Approach Point, Glideslope/path Intercept Altitude, Segments of an Instrument Approach Procedure)

FINAL APPROACH—IFR— The flight path of an aircraft which is inbound to an airport on a final instrument approach course, beginning at the final approach fix or point and extending to the airport or the point where a circle-to-land maneuver or a missed approach is executed. (See Segments of an Instrument Approach Procedure, Final Approach Fix, Final Approach Course, Final Approach Point)

ICAO—FINAL APPROACH— That part of an instrument approach procedure from the time the aircraft has:

1. Completed the last procedure turn or base turn, where one is specified, or
2. Crossed a specified fix, or
3. Intercepted the last track specified for the procedures until it has crossed a point in the vicinity of an aerodrome from which:
    a. A landing can be made, or
    b. A missed approach procedure is initiated.

FINAL APPROACH POINT/FAP— The point, applicable only to a nonprecision approach with no depicted FAF (such as an on-airport VOR), where the aircraft is established inbound on the final approach course from the procedure turn and where the final approach descent may be commenced. The FAP serves as the FAF and identifies the beginning of the final approach segment. (See Final Approach Fix, Segments of an Instrument Approach Procedure)

FINAL APPROACH SEGMENT— (See Segments of an Instrument Approach Procedure)

FINAL APPROACH—VFR— (See Traffic Pattern)

FINAL CONTROLLER— The controller providing information and final approach guidance during PAR and ASR approaches utilizing radar equipment. (See Radar Approach)

FIX— A geographical position determined by visual reference to the surface, by reference to one or more radio NAVAIDs, by celestial plotting, or by another navigational device.

FLAG/FLAG ALARM— A warning device incorporated in certain airborne navigation and flight instruments indicating that:

1. Instruments are inoperative or otherwise not operating satisfactorily, or
2. Signal strength or quality of the received signal falls below acceptable values.

FLAMEOUT— Unintended loss of combustion in turbine engines resulting in the loss of engine power.

FLIGHT CHECK— A call-sign prefix used by FAA aircraft engaged in flight inspection/certification of navigational aids and flight procedures. The word "recorded" may be added as a suffix; e.g., "Flight Check 320 recorded" to indicate that an automated flight inspection is in progress in terminal areas. (See Flight Inspection/Flight Check) (Refer to AIM).

FLIGHT INFORMATION REGION/FIR— An airspace of defined dimensions within which Flight Information Service and Alerting Service are provided.

1. Flight Information Service—A service provided for the purpose of giving advice and information useful for the safe and efficient conduct of flights.
2. Alerting Service—A service provided to notify appropriate organizations regarding aircraft in need of search and rescue aid and to assist such organizations as required.

FLIGHT INSPECTION/FLIGHT CHECK— Inflight investigation and evaluation of a navigational aid to determine whether it meets established tolerances. (See Navigational Aid)

FLIGHT LEVEL— A level of constant atmospheric pressure related to a reference datum of 29.92 inches of mercury. Each is stated in three digits that represent hundreds of feet. For example, flight level 250 represents a barometric altimeter indication of 25,000 feet; flight level 255, an indication of 25,500 feet.

*ICAO—FLIGHT LEVELS—*Surfaces of constant atmospheric pressure which are related to a specific pressure datum, 1013.2 mb (29.92 inches) and are separated by specific pressure intervals.

FLIGHT LINE— A term used to describe the precise movement of a civil photogrammetric aircraft along a predetermined course(s) at a predetermined altitude during the actual photographic run.

FLIGHT PATH— A line, course, or track along which an aircraft is flying or intended to be flown. (See Track, Course)

FLIGHT PLAN— Specified information relating to the intended flight of an aircraft that is filed orally or in writing with an FSS or an ATC facility. (See Fast File, Filed) (Refer to AIM)

FLIGHT RECORDER— A general term applied to any instrument or device that records information about the performance of an aircraft in flight or about conditions encountered in flight. Flight recorders may make records of airspeed, outside air temperature, vertical acceleration, engine RPM, manifold pressure, and other pertinent variables for a given flight.

ICAO—FLIGHT RECORDER—Any type of recorder installed in the aircraft for the purpose of complementing accident/incident investigation.

FLIGHT SERVICE STATION/FSS— Air traffic facilities which provide pilot briefing, en route communications and VFR search and rescue services, assist lost aircraft and aircraft in emergency situations, relay ATC clearances, originate Notices to Airmen, broadcast aviation weather and NAS information, receive and process IFR flight plans, and monitor NAVAID's. In addition, at selected locations FSS's provide Enroute Flight Advisory Service (Flight Watch), take weather observations, issue airport advisories, and advise Customs and Immigration of transborder flights. (Refer to AIM)

FLIGHT STANDARDS DISTRICT OFFICE/FSDO— An FAA field office serving an assigned geographical area and staffed with Flight Standards personnel who serve the aviation industry and the general public on matters relating to the certification and operation of air carrier and general aviation aircraft. Activities include general surveillance of operational safety, certification of airmen and aircraft, accident prevention, investigation, enforcement, etc.

FLIGHT TEST— A flight for the purpose of:

1. Investigating the operation/flight characteristics of an aircraft or aircraft component.
2. Evaluating an applicant for a pilot certificate or rating.

FLIGHT VISIBILITY— (See Visibility)

FLIGHT WATCH— A shortened term for use in air-ground contacts on frequency 122.0 MHz to identify the flight service station providing En Route Flight Advisory Service; e.g., "Oakland Flight Watch." (See En Route Flight Advisory Service)

FLIP— (See DOD FLIP)

FLOW CONTROL— Measures designed to adjust the flow of traffic into a given airspace, along a given route, or bound for a given aerodrome (airport) so as to ensure the most effective utilization of the airspace. (See Quota Flow Control) (Refer to Airport/Facility Directory

FLY HEADING (DEGREES)— Informs the pilot of the heading he should fly. The pilot may have to turn to, or continue on, a specific compass direction in order to comply with the instructions. The pilot is expected to turn in the shorter direction to the heading unless otherwise instructed by ATC.

FORMATION FLIGHT— More than one aircraft which, by prior arrangement between the pilots, operate as a single aircraft with regard to navigation and position reporting. Separation between aircraft within the formation is the responsibility of the flight leader and the pilots of the other aircraft in the flight. This includes transition periods when aircraft within the formation are maneuvering to attain separation from each other to effect individual control and during join-up and breakaway.

1. A standard formation is one in which a proximity of no more than 1 mile laterally or longitudinally and within 100 feet vertically from the flight leader is maintained by each wingman.
2. Nonstandard formations are those operating under any of the following conditions:
   a. When the flight leader has requested and ATC has approved other than standard formation dimensions.
   b. When operating within an authorized altitude reservation (ALTRV) or under the provisions of a letter of agreement.
   c. When the operations are conducted in airspace specifically designed for a special activity. (See Altitude Reservation) (Refer to FAR Part 91)

FSS— (See Flight Service Station)

FUEL DUMPING— Airborne release of usable fuel. This does not include the dropping of fuel tanks. (See Jettisoning of External Stores)

FUEL SIPHONING/FUEL VENTING— Unintentional release of fuel caused by overflow, puncture, loose cap, etc.

GATE HOLD PROCEDURES— Procedures at selected airports to hold aircraft at the gate or other ground location whenever departure delays exceed or are anticipated to exceed 5 minutes. The sequence for departure will be maintained in accordance with initial call-up unless modified by Flow Control restrictions. Pilots should monitor the ground control/clearance delivery frequency for engine startup advisories or new proposed start time if the delay changes. (See Flow Control)

GENERAL AVIATION— That portion of civil aviation which encompasses all facets of aviation except air carriers holding a certificate of public convenience and necessity from the Civil Aeronautics Board and large aircraft commercial operators.

ICAO—GENERAL AVIATION—All civil aviation operations other than scheduled air services and non-scheduled air transport operations for remuneration or hire.

GENERAL AVIATION DISTRICT OFFICE/GADO— An FAA field office serving a designated geographical area and staffed with Flight Standards personnel who have the responsibility for serving the aviation industry and the general public on all matters relating to the certification and operation of general aviation aircraft.

GLIDESLOPE/GLIDEPATH— Provides vertical guidance for aircraft during approach and landing. The glideslope/glidepath is based on the following:

1. Electronic components emitting signals which provide vertical guidance by reference to airborne instruments during instrument approaches such as ILS/MLS, or
2. Visual ground aids, such as VASI, which provide vertical guidance for a VFR approach or for the visual portion of an instrument approach and landing.
3. PAR. Used by ATC to inform an aircraft making a PAR approach of its vertical position (elevation) relative to the descent profile.

ICAO—GLIDEPATH— A descent profile determined for vertical guidance during a final approach.

GLIDESLOPE/GLIDEPATH INTERCEPT ALTITUDE— The minimum altitude to intercept the glideslope/path on a precision approach. The intersection of the published intercept altitude with the glideslope/path, designated on Government charts by the lightning bolt symbol, is the precision FAF; however, when ATC directs a lower altitude, the resultant lower intercept position is then the FAF. (See Final Approach Fix, Segments of an Instrument Approach Procedure)

GO AHEAD— Proceed with your message. Not to be used for any other purpose.

GO AROUND— Instructions for a pilot to abandon his approach to landing. Additional instructions may follow. Unless otherwise advised by ATC, a VFR aircraft or an aircraft conducting visual approach should overfly the runway while climbing to traffic pattern altitude and enter the traffic pattern via the crosswind leg. A pilot on an IFR flight plan making an instrument approach should execute the published missed approach procedure or proceed as instructed by ATC; e.g., "Go around" (additional instructions if required). (See Low Approach, Missed Approach)

GROUND CLUTTER— A pattern produced on the radar scope by ground returns which may degrade other radar returns in the affected area. The effect of ground clutter is minimized by the use of moving target indicator (MTI) circuits in the radar equipment resulting in a radar presentation which displays only targets which are in motion. (See Clutter)

GROUND CONTROLLED APPROACH/GCA— A radar approach system operated from the ground by air traffic control personnel transmitting instructions to the pilot by radio. The approach may be conducted with surveillance radar (ASR) only or with both surveillance and precision approach radar (PAR). Usage of the term "GCA" by pilots is discouraged except when referring to a GCA facility. Pilots should specifically request a "PAR" approach when a precision radar approach is desired or request an "ASR" or "surveillance" approach when a nonprecision radar approach is desired. (See Radar Approach)

GROUND DELAY— The amount of delay attributed to ATC, encountered prior to departure, usually associated with a CDT program.

GROUND SPEED— The speed of an aircraft relative to the surface of the earth.

GROUND VISIBILITY— (See Visibility)

HANDOFF— An action taken to transfer the radar identification of an aircraft from one controller to another if the aircraft will enter the receiving controller's airspace and radio communications with the aircraft will be transferred.

HAVE NUMBERS— Used by pilots to inform ATC that they have received runway, wind, and altimeter information only.

HAZARDOUS INFLIGHT WEATHER ADVISORY SERVICE/HIWAS— A program for broadcasting hazardous weather information (SIGMET's, Convective SIGMET's, CWA's, AIRMET's, and Urgent PIREP's) on a continuous basis over selected VOR's. (Refer to AIM)

HEAVY (AIRCRAFT)— (See Aircraft Classes)

HEIGHT ABOVE AIRPORT/HAA— The height of the Minimum Descent Altitude above the published airport elevation. This is published in conjunction with circling minimums. (See Minimum Descent Altitude)

HEIGHT ABOVE LANDING/HAL— The height above a designated helicopter landing area used for helicopter instrument approach procedures. (Refer to FAR Part 97)

HEIGHT ABOVE TOUCHDOWN/HAT— The height of the Decision Height or Minimum Descent Altitude above the highest runway elevation in the touchdown zone (first 3,000 feet of the runway). HAT is published on instrument approach charts in conjunction with all straight-in minimums. (See Decision Height, Minimum Descent Altitude)

HELICOPTER/COPTER— Rotorcraft that, for its horizontal motion, depends principally on its engine-driven rotors.

*ICAO—HELICOPTER—*A heavier-than-air aircraft supported in flight by the reactions of the air on one or more power-driven rotors on substantially vertical axes.

HELIPAD— A small, designated area, usually with a prepared surface, on a heliport, airport, landing/takeoff area, apron/ramp, or movement area used for takeoff, landing, or parking of helicopters.

HELIPORT— An area of land, water, or structure used or intended to be used for the landing and takeoff of helicopters and includes its buildings and facilities if any.

HERTZ/Hz— The standard radio equivalent of frequency in cycles per second of an electromagnetic wave. Kilohertz (kHz) is a frequency of one thousand cycles per second. Megahertz (MHz) is a frequency of one million cycles per second.

HIGH FREQUENCY/HF— The frequency band between 3 and 30 MHz. (See High Frequency Communications)

HIGH FREQUENCY COMMUNICATIONS/HF COMMUNICATIONS— High radio frequencies (HF) between 3 and 30 MHz used for air-to-ground voice communication in overseas operations.

HIGH SPEED TAXIWAY/EXIT/TURNOFF— A long radius taxiway designed and provided with lighting or marking to define the path of aircraft, traveling at high speed (up to 60 knots), from the runway center to a point on the center of a taxiway. Also referred to as long radius exit or turn-off taxiway. The high speed taxiway is designed to expedite aircraft turning off the runway after landing, thus reducing runway occupancy time.

HOLD/HOLDING PROCEDURE— A predetermined maneuver which keeps aircraft within a specified airspace while awaiting further clearance from air traffic control. Also used during ground operations to keep aircraft within a specified area or at a specified point while awaiting further clearance from air traffic control. (See Holding Fix) (Refer to AIM)

HOLDING FIX— A specified fix identifiable to a pilot by NAVAID's or visual reference to the ground used as a reference point in establishing and maintaining the position of an aircraft while holding. (See Fix, Hold, Visual Holding) (Refer to AIM)

HOLD FOR RELEASE— Used by ATC to delay an aircraft for traffic management reasons; i.e., weather, traffic volume, etc. Hold for release instructions (including departure delay information) are used to inform a pilot or a controller (either directly or through an authorized relay) that a departure clearance is not valid until a release time or additional instructions have been received.

ICAO—HOLDING POINT— A specified location, identified by visual or other means, in the vicinity of which the position of an aircraft in flight is maintained with air traffic control clearances.

HOMING— Flight toward a NAVAID, without correcting for wind, by adjusting the aircraft heading to maintain a relative bearing of zero degrees. (See Bearing)

*ICAO—HOMING—*The procedure of using the direction-finding equipment of one radio station with the emission of another radio station, where at least one of the stations is mobile, and whereby the mobile station proceeds continuously towards the other station.

HOVER CHECK— Used to describe when a helicopter/VTOL aircraft requires a stabilized hover to conduct a performance/power check prior to hover taxi, air taxi, or takeoff. Altitude of the hover will vary based on the purpose of the check.

HOVER TAXI— Used to describe a helicopter/VTOL aircraft movement conducted above the surface and in ground effect at airspeeds less than approximately 20 knots. The actual height may vary, and some helicopters may require hover taxi above 25 feet AGL to reduce ground effect turbulence or provide clearance for cargo slingloads. (See Air Taxi, Hover Check) (Refer to AIM)

HOW DO YOU HEAR ME?— A question relating to the quality of the transmission or to determine how well the transmission is being received.

IDENT— A request for a pilot to activate the aircraft transponder identification feature. This will help the controller to confirm an aircraft identity or to identify an aircraft. (Refer to AIM)

IDENT FEATURE— The special feature in the Air Traffic Control Radar Beacon System (ATCRBS) equipment. It is used to immediately distinguish one displayed beacon target from other beacon targets. (See Ident)

IF FEASIBLE, REDUCE SPEED TO (SPEED)— (See Speed Adjustment)

IF NO TRANSMISSION RECEIVED FOR (TIME)— Used by ATC in radar approaches to prefix procedures which should be followed by the pilot in event of lost communications. (See Lost Communications)

IFR AIRCRAFT/IFR FLIGHT— An aircraft conducting flight in accordance with instrument flight rules.

IFR CONDITIONS— Weather conditions below the minimum for flight under visual flight rules. (See Instrument Meteorological Conditions)

IFR DEPARTURE PROCEDURE— (See IFR Takeoff Minimums and Departure Procedures) (Refer to AIM)

IFR MILITARY TRAINING ROUTES (IR)— Routes used by the Department of Defense and associated Reserve and Air Guard units for the purpose of conducting low-altitude navigation and tactical training in both IFR and VFR weather conditions below 10,000 feet MSL at airspeeds in excess of 250 knots IAS.

IFR TAKEOFF MINIMUMS AND DEPARTURE PROCEDURES— FAR, Part 91, prescribes standard takeoff rules for certain civil users. At some airports, obstructions or other factors require the establishment of nonstandard takeoff minimums, departure procedures, or both to assist pilots in avoiding obstacles during climb to the minimum en route altitude. Those airports are listed in NOS/DOD Instrument Approach Charts (IAP's) under a section entitled "IFR Takeoff Minimums and Departure Procedures." The NOS/DOD IAP chart legend illustrates the symbol used to alert the pilot to nonstandard takeoff minimums and departure procedures. When departing IFR from such airports or from any airports where there are no departure procedures, SID's, or ATC facilities available, pilots should advise ATC of any departure limitations. Controllers may query a pilot to determine acceptable departure directions, turns, or headings after takeoff. Pilots should be familiar with the departure procedures and must assure that their aircraft can meet or exceed any specified climb gradients.

ILS CATEGORIES—

1. ILS Category I—An ILS approach procedure which provides for approach to a height above

touchdown of not less than 200 feet and with runway visual range of not less than 1,800 feet.

2. ILS Category II—An ILS approach procedure which provides for approach to a height above touchdown of not less than 100 feet and with runway visual range of not less than 1,200 feet.
3. ILS Category III.
    - a. IIIA—An ILS approach procedure which provides for approach without a decision height minimum and with runway visual range of not less than 700 feet.
    - b. IIIB—An ILS approach procedure which provides for approach without a decision height minimum and with runway visual range of not less than 150 feet.
    - c. IIIC—An ILS approach procedure which provides for approach without a decision height minimum and without runway visual range minimum.

IMMEDIATELY— Used by ATC when such action compliance is required to avoid an imminent situation.

INCREASE SPEED TO (SPEED)— (See Speed Adjustment)

INFORMATION REQUEST/INREQ— A request originated by an FSS for information concerning an overdue VFR aircraft.

INITIAL APPROACH FIX/IAF— The fixes depicted on instrument approach procedure charts that identify the beginning of the initial approach segment(s). (See Fix, Segments of an Instrument Approach Procedure)

INITIAL APPROACH SEGMENT— (See Segments of an Instrument Approach Procedure)

INNER MARKER/IM/INNER MARKER BEACON— A marker beacon used with an ILS (CAT II) precision approach located between the middle marker and the end of the ILS runway, transmitting a radiation pattern keyed at six dots per second and indicating to the pilot, both aurally and visually, that he is at the designated decision height (DH), normally 100 feet above the touchdown zone elevation, on the ILS CAT II approach. It also marks progress during a CAT III approach. (See Instrument Landing System) (Refer to AIM)

INSTRUMENT APPROACH PROCEDURE/IAP/INSTRUMENT APPROACH— A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing or to a point from which a landing may be made visually. It is prescribed and approved for a specific airport by competent authority. (See Segments of an Instrument Approach Procedure) (Refer to FAR, Part 91, AIM)

1. U. S. civil standard instrument approach procedures are approved by the FAA as prescribed under FAR, Part 97 and are available for public use.
2. U.S. military standard instrument approach procedures are approved and published by the Department of Defense.
3. Special instrument approach procedures are approved by the FAA for individual operators but are not published in FAR, Part 97 for public use.

ICAO—INSTRUMENT APPROACH PROCEDURE— A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing, or to a point from which a landing may be made visually.

INSTRUMENT FLIGHT RULES/IFR— Rules governing the procedures for conducting instrument flight. Also a term used by pilots and controllers to indicate type of flight plan. (See Visual Flight Rules, Instrument Meteorological Conditions, Visual Meteorological Conditions) (Refer to AIM)

*ICAO—INSTRUMENT FLIGHT RULES—*A set of rules governing the conduct of flight under instrument meteorological conditions.

INSTRUMENT LANDING SYSTEM/ILS— A precision instrument approach system which normally consists of the following electronic components and visual aids:

1. Localizer. (See Localizer)
2. Glideslope. (See Glideslope)
3. Outer Marker. (See Outer Marker)
4. Middle Marker. (See Middle Marker)
5. Approach Lights. (See Airport Lighting)

(Refer to FAR Part 91, AIM)

INSTRUMENT METEOROLOGICAL CONDITIONS/IMC— Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling less than the minima specified for visual meteorological conditions. (See Visual Meteorological Conditions, Instrument Flight Rules, Visual Flight Rules)

INSTRUMENT RUNWAY— A runway equipped with electronic and visual navigation aids for which a precision or nonprecision approach procedure having straight-in landing minimums has been approved.

*ICAO—INSTRUMENT RUNWAY—*A runway intended for the operation of aircraft using nonvisual aids and comprising:

1. Instrument Approach Runway—An instrument runway served by a nonvisual aid providing at least directional guidance adequate for a straight-in approach.
2. Precision Approach Runway, Category I—An instrument runway served by ILS or GCA approach aids and visual aids intended for operations down to 60 metres (200 feet) decision height and down to an RVR of the order of 800 metres (2,600 feet.)
3. Precision Approach Runway, Category II—An instrument runway served by ILS and visual aids intended for operations down to 30 metres (100 feet) decision height and down to an RVR of the order of 400 metres (1,200 feet.)

4. Precision Approach Runway, Category III—An instrument runway served by ILS (no decision height being applicable) and:
   a. By visual aids intended for operations down to an RVR of the order of 200 metres (700 feet);
   b. By visual aids intended for operations down to an RVR of the order of 50 metres (150 feet);
   c. Intended for operations without reliance on external visual reference.

INTERMEDIATE APPROACH SEGMENT— (See Segments of an Instrument Approach Procedure)

INTERMEDIATE FIX/IF— The fix that identifies the beginning of the intermediate approach segment of an instrument approach procedure. The fix is not normally identified on the instrument approach chart as an intermediate fix (IF). (See Segments of an Instrument Approach Procedure)

INTERNATIONAL AIRPORT— Relating to international flight, it means:

1. An airport of entry which has been designated by the Secretary of Treasury or Commissioner of Customs as an international airport for customs service.
2. A landing rights airport at which specific permission to land must be obtained from customs authorities in advance of contemplated use.
3. Airports designated under the Convention on International Civil Aviation as an airport for use by international commercial air transport and/or international general aviation. (Refer to Airport/Facility Directory and IFIM).

ICAO—INTERNATIONAL AIRPORT—Any airport designated by the Contracting State in whose territory it is situated as an airport of entry and departure for international air traffic, where the formalities incident to customs, immigration, public health, animal and plant quarantine, and similar procedures are carried out.

INTERNATIONAL CIVIL AVIATION ORGANIZATION/ICAO— A specialized agency of the United Nations whose objective is to develop the principles and techniques of international air navigation and to foster planning and development of international civil air transport.

INTERNATIONAL FLIGHT INFORMATION MANUAL/IFIM— A publication designed primarily as a pilot's preflight planning guide for flights into foreign airspace and for flights returning to the U.S. from foreign locations.

INTERROGATOR— The ground-based surveillance radar beacon transmitter-receiver, which normally scans in synchronism with a primary radar, transmitting discrete radio signals which repetitiously request all transponders on the mode being used to reply. The replies received are mixed with the primary radar returns and displayed on the same plan position indicator (radar scope). Also, applied to the airborne element of the TACAN/DME system. (See Transponder) (Refer to AIM)

INTERSECTING RUNWAYS— Two or more runways which cross or meet within their lengths. (See Intersection)

INTERSECTION—

1. A point defined by any combination of courses, radials, or bearings of two or more navigational aids.
2. Used to describe the point where two runways, a runway and a taxiway, or two taxiways cross or meet.

INTERSECTION DEPARTURE/INTERSECTION TAKEOFF— A takeoff or proposed takeoff on a runway from an intersection. (See Intersection)

I SAY AGAIN— The message will be repeated.

JAMMING— Electronic or mechanical interference which may disrupt the display of aircraft on radar or the transmission/reception of radio communications/navigation.

JET BLAST— Jet engine exhaust (thrust stream turbulence). (See Wake Turbulence)

JET ROUTE— A route designed to serve aircraft operations from 18,000 feet MSL up to and including flight level 450. The routes are referred to as "J" routes with numbering to identify the designated route; e.g., J105. (See Route) (Refer to FAR Part 71)

JET STREAM— A migrating stream of high-speed winds present at high altitudes.

JETTISONING OF EXTERNAL STORES— Airborne release of external stores; e.g., tiptanks, ordnance. (See Fuel Dumping) (Refer to FAR Part 91)

JOINT USE RESTRICTED AREA— (See Restricted Area)

KNOWN TRAFFIC— With respect to ATC clearances, means aircraft whose altitude, position, and intentions are known to ATC.

LANDING/TAKEOFF AREA— Any locality either on land, water, or structures, including airports/heliports and intermediate landing fields, which is used, or intended to be used, for the landing and takeoff of aircraft whether or not facilities are provided for the shelter, servicing, or for receiving or discharging passengers or cargo.

ICAO—LANDING AREA—That part of the movement area intended for the landing and takeoff of aircraft.

LANDING DIRECTION INDICATOR— A device which visually indicates the direction in which landings and takeoffs should be made. (See Tetrahedron) (Refer to AIM)

LANDING MINIMUMS/IFR LANDING MINIMUMS— The minimum visibility prescribed for landing a civil aircraft while using an instrument approach procedure. The minimum applies with other limitations set forth in FAR Part 91 with respect to the Minimum Descent Altitude (MDA) or Decision Height (DH) prescribed in the instrument approach procedures as follows:

1. Straight-in landing minimums—A statement of MDA and visibility, or DH and visibility, required for a straight-in landing on a specified runway, or
2. Circling minimums— A statement of MDA and visibility required for the circle-to-land maneuver.

Descent below the established MDA or DH is not authorized during an approach unless the aircraft is in a position from which a normal approach to the runway of intended landing can be made and adequate visual reference to required visual cues is maintained. (See Straight-in Landing, Circle-to-Land Maneuver, Decision Height, Minimum Descent Altitude, Visibility, Instrument Approach Procedure) (Refer to FAR Part 91)

LANDING ROLL— The distance from the point of touchdown to the point where the aircraft can be brought to a stop or exit the runway.

LANDING SEQUENCE— The order in which aircraft are positioned for landing. (See Approach Sequence)

LAST ASSIGNED ALTITUDE— The last altitude/flight level assigned by ATC and acknowledged by the pilot. (See Maintain) (Refer to FAR Part 91)

LATERAL SEPARATION— The lateral spacing of aircraft at the same altitude by requiring operation on different routes or in different geographical locations. (See Separation)

LIGHTED AIRPORT— An airport where runway and obstruction lighting is available. (See Airport Lighting) (Refer to AIM)

LIGHT GUN— A handheld directional light signaling device which emits a brilliant narrow beam of white, green, or red light as selected by the tower controller. The color and type of light transmitted can be used to approve or disapprove anticipated pilot actions where radio communication is not available. The light gun is used for controlling traffic operating in the vicinity of the airport and on the airport movement area. (Refer to AIM)

LOCALIZER— The component of an ILS which provides course guidance to the runway. (See Instrument Landing System) (Refer to AIM)

ICAO—LOCALIZER COURSE (ILS)— The locus of points, in any given horizontal plane, at which the DDM (difference in depth of modulation) is zero.

LOCALIZER TYPE DIRECTIONAL AID/LDA— A NAVAID used for nonprecision instrument approaches with utility and accuracy comparable to a localizer but which is not a part of a complete ILS and is not aligned with the runway. (Refer to AIM)

LOCALIZER USABLE DISTANCE— The maximum distance from the localizer transmitter at a specified altitude, as verified by flight inspection, at which reliable course information is continuously received. (Refer to AIM)

LOCAL TRAFFIC— Aircraft operating in the traffic pattern or within sight of the tower, or aircraft known to be departing or arriving from flight in local practice areas, or aircraft executing practice instrument approaches at the airport. (See Traffic Pattern)

LONGITUDINAL SEPARATION— The longitudinal spacing of aircraft at the same altitude by a minimum distance expressed in units of time or miles. (See Separation) (Refer to AIM)

LORAN/LONG RANGE NAVIGATION— An electronic navigational system by which hyperbolic lines of position are determined by measuring the difference in the time of reception of synchronized pulse signals from two fixed transmitters. Loran A operates in the 1750—1950 kHz frequency band. Loran C and D operate in the 100—110 kHz frequency band. (Refer to AIM)

LOST COMMUNICATIONS/TWO-WAY RADIO COMMUNICATIONS FAILURE— Loss of the ability to communicate by radio. Aircraft are sometimes referred to as NORDO (No Radio). Standard pilot procedures are specified in FAR Part 91. Radar controllers issue procedures for pilots to follow in the event of lost communications during a radar approach when weather reports indicate that an aircraft will likely encounter IFR weather conditions during the approach. (Refer to FAR Part 91, AIM)

LOW ALTITUDE AIRWAY STRUCTURE/FEDERAL AIRWAYS— The network of airways serving aircraft operations up to but not including 18,000 feet MSL. (See Airway) (Refer to AIM)

LOW ALTITUDE ALERT, CHECK YOUR ALTITUDE IMMEDIATELY— (See Safety Alert)

LOW ALTITUDE ALERT SYSTEM/LAAS— An automated function of the TPX-42 that alerts the controller when a Mode C transponder-equipped aircraft on an IFR flight plan is below a predetermined minimum safe altitude. If requested by the pilot, LAAS monitoring is also available to VFR Mode C transponder-equipped aircraft.

LOW APPROACH— An approach over an airport or runway following an instrument approach or a VFR approach including the go-around maneuver where the pilot intentionally does not make contact with the runway. (Refer to AIM)

LOW FREQUENCY/LF— The frequency band between 30 and 300 kHz. (Refer to AIM)

MACH NUMBER— The ratio of true airspeed to the speed of sound; e.g., MACH .82, MACH 1.6. (See Airspeed)

MAINTAIN—

1. Concerning altitude/flight level, the term means to remain at the altitude/flight level specified. The phrase "climb and" or "descend and" normally precedes "maintain" and the altitude assignment; e.g., "descend and maintain 5,000."
2. Concerning other ATC instructions, the term is used in its literal sense; e.g., maintain VFR.

MAKE SHORT APPROACH— Used by ATC to inform a pilot to alter his traffic pattern so as to make a short final approach. (See Traffic Pattern)

MANDATORY ALTITUDE— An altitude depicted on an instrument Approach Procedure Chart requiring the aircraft to maintain altitude at the depicted value.

MARKER BEACON— An electronic navigation facility transmitting a 75 MHz vertical fan or boneshaped radiation pattern. Marker beacons are identified by their modulation frequency and keying code, and when received by compatible airborne equipment, indicate to the pilot, both aurally and visually, that he is passing over the facility. (See Outer Marker, Middle Marker, Inner Marker) (Refer to AIM)

MAXIMUM AUTHORIZED ALTITUDE/MAA— A published altitude representing the maximum usable altitude or flight level for an airspace structure or route segment. It is the highest altitude on a Federal airway, jet route, area navigation low or high route, or other direct route for which an MEA is designated in FAR Part 95 at which adequate reception of navigation aid signals is assured.

MAYDAY— The international radiotelephony distress signal. When repeated three times, it indicates imminent and grave danger and that immediate assistance is requested. (See Pan-Pan) (Refer to AIM)

METEOROLOGICAL IMPACT STATEMENT/MIS— An unscheduled planning forecast describing conditions expected to begin within 4 to 12 hours which may impact the flow of air traffic in a specific center's (ARTCC) area.

METERING— A method of time-regulating arrival traffic flow into a terminal area so as not to exceed a predetermined terminal acceptance rate.

METERING FIX— A fix along an established route from over which aircraft will be metered prior to entering terminal airspace. Normally, this fix should be established at a distance from the airport which will facilitate a profile descent 10,000 feet above airport elevation (AAE) or above.

MIA— (See Minimum IFR Altitudes)

MICROWAVE LANDING SYSTEM/MLS— A precision instrument approach system operating in the microwave spectrum which normally consists of the following components:

1. Azimuth Station.
2. Elevation Station.
3. Precision Distance Measuring Equipment. (See MLS Categories)

MIDDLE COMPASS LOCATOR— (See Compass Locator)

MIDDLE MARKER/MM— A marker beacon that defines a point along the glide slope of an ILS normally located at or near the point of decision height (ILS Category I). It is keyed to transmit alternate dots and dashes, with the alternate dots and dashes keyed at the rate of 95 dot/dash combinations per minute on a 1300 Hz tone, which is received aurally and visually by compatible airborne equipment. (See Marker Beacon, Instrument Landing System) (Refer to AIM)

MID RVR— (See Visibility)

MILITARY AUTHORITY ASSUMES RESPONSIBILITY FOR SEPARATION OF AIRCRAFT/MARSA— A condition whereby the military services involved assume responsibility for separation between participating military aircraft in the ATC system. It is used only for required IFR operations which are specified in letters of agreement or other appropriate FAA or military documents.

MILITARY OPERATIONS AREA/MOA— (See Special Use Airspace)

MILITARY TRAINING ROUTES/MTR— Airspace of defined vertical and lateral dimensions established for the conduct of military flight training at airspeeds in excess of 250 knots IAS. (See IFR (IR) and VFR (VR) Military Training Routes)

MINIMUM CROSSING ALTITUDE/MCA— The lowest altitude at certain fixes at which an aircraft must cross when proceeding in the direction of a higher minimum en route IFR altitude (MEA). (See Minimum En Route IFR Altitude)

MINIMUM DESCENT ALTITUDE/MDA— The lowest altitude, expressed in feet above mean sea level, to which descent is authorized on final approach or during circle-to-land maneuvering in execution of a standard instrument approach procedure where no electronic glide slope is provided. (See Nonprecision Approach Procedure)

MINIMUM EN ROUTE IFR ALTITUDE/MEA— The lowest published altitude between radio fixes which assures acceptable navigational signal coverage and meets obstacle clearance requirements between those fixes. The MEA prescribed for a Federal airway or segment thereof, area navigation low or high route, or other direct route applies to the entire width of the airway, segment, or route between the radio fixes defining the airway, segment, or route. (Refer to FAR Parts 91 and 95; AIM)

MINIMUM FUEL— Indicates that an aircraft's fuel supply has reached a state where, upon reaching the destination, it can accept little or no delay. This is not an emergency situation but merely indicates an emergency situation is possible should any undue delay occur. (Refer to AIM)

MINIMUM HOLDING ALTITUDE/MHA— The lowest altitude prescribed for a holding pattern which assures navigational signal coverage, communications, and meets obstacle clearance requirements.

MINIMUM IFR ALTITUDES/MIA— Minimum altitudes for IFR operations as prescribed in FAR Part 91. These altitudes are published on aeronautical charts and prescribed in FAR Part 95 for airways and routes, and in FAR Part 97 for standard instrument approach procedures. If no applicable minimum altitude is prescribed in FAR Parts 95 or 97, the following minimum IFR altitude applies:

1. In designated mountainous areas, 2,000 feet above the highest obstacle within a horizontal

distance of 5 statute miles from the course to be flown; or

2. Other than mountainous areas, 1,000 feet above the highest obstacle within a horizontal distance of 5 statute miles from the course to be flown; or
3. As otherwise authorized by the Administrator or assigned by ATC. (See Minimum En Route IFR Altitude, Minimum Obstruction Clearance Altitude, Minimum Crossing Altitude, Minimum Safe Altitude, Minimum Vectoring Altitude) (Refer to FAR Part 91)

MINIMUM OBSTRUCTION CLEARANCE ALTITUDE/MOCA— The lowest published altitude in effect between radio fixes on VOR airways, off-airway routes, or route segments which meets obstacle clearance requirements for the entire route segment and which assures acceptable navigational signal coverage only within 25 statute (22 nautical) miles of a VOR. (Refer to FAR Part 91 and 95)

MINIMUM RECEPTION ALTITUDE/MRA— The lowest altitude at which an intersection can be determined. (Refer to FAR Part 95)

MINIMUM SAFE ALTITUDE/MSA—

1. The minimum altitude specified in FAR Part 91 for various aircraft operations.
2. Altitudes depicted on approach charts which provide at least 1,000 feet of obstacle clearance for emergency use within a specified distance from the navigation facility upon which a procedure is predicated. These altitudes will be identified as Minimum Sector Altitudes or Emergency Safe Altitudes and are established as follows:
   a. Minimum Sector Altitudes—Altitudes depicted on approach charts which provide at least 1,000 feet of obstacle clearance within a 25-mile radius of the navigation facility upon which the procedure is predicated. Sectors depicted on approach charts must be at least 90 degrees in scope. These altitudes are for emergency use only and do not necessarily assure acceptable navigational signal coverage.

ICAO—MINIMUM SECTOR ALTITUDE— The lowest altitude which may be used under emergency conditions which will provide a minimum clearance of 300 meters (1,000 feet) above all obstacles located in an area contained within a sector of a circle of 25 nautical mile radius centered on a radio aid to navigation.

   b. Emergency Safe Altitudes—Altitudes depicted on approach charts which provide at least 1,000 feet of obstacle clearance in nonmountainous areas and 2,000 feet of obstacle clearance in designated mountainous areas within a 100-mile radius of the navigation facility upon which the procedure is predicated and normally used only in military procedures. These altitudes are identified on published procedures as "Emergency Safe Altitudes."

MINIMUM SAFE ALTITUDE WARNING (MSAW)— A function of the ARTS III computer that aids the controller by alerting him when a tracked Mode C-equipped aircraft is below or is predicted by the computer to go below a predetermined minimum safe altitude. (Refer to AIM)

MINIMUMS/MINIMA— Weather condition requirements established for a particular operation or type of operation; e.g., IFR takeoff or landing, alternate airport for IFR flight plans, VFR flight, etc. (See Landing Minimums, IFR Takeoff Minimums, VFR Conditions, IFR Conditions) (Refer to FAR Part 91, AIM)

MINIMUM VECTORING ALTITUDE/MVA— The lowest MSL altitude at which an IFR aircraft will be vectored by a radar controller, except as otherwise authorized for radar approaches, departures, and missed approaches. The altitude meets IFR obstacle clearance criteria. It may be lower than the published MEA along an airway or J-route segment. It may be utilized for radar vectoring only upon the controller's determination that an adequate radar return is being received from the aircraft being controlled. Charts depicting minimum vectoring altitudes are normally available only to the controllers and not to pilots. (Refer to AIM)

MISSED APPROACH—

1. A maneuver conducted by a pilot when an instrument approach cannot be completed to a landing. The route of flight and altitude are shown on instrument approach procedure charts. A pilot executing a missed approach prior to the Missed Approach Point (MAP) must continue along the final approach to the MAP. The pilot may climb immediately to the altitude specified in the missed approach procedure.
2. A term used by the pilot to inform ATC that he is executing the missed approach.
3. At locations where ATC radar service is provided, the pilot should conform to radar vectors when provided by ATC in lieu of the published missed approach procedure. (See Missed Approach Point) (Refer to AIM)

ICAO—MISSED APPROACH PROCEDURE— The procedure to be followed if, after an instrument approach, a landing is not effected, and occuring normally:

1. When the aircraft has descended to the decision height and has not established visual contact, or
2. When directed by air traffic control to pull up or to go around again.

MISSED APPROACH POINT/MAP— A point prescribed in each instrument approach procedure at which a missed approach procedure shall be executed if the required visual reference does not exist. (See Missed Approach, Segments of an Instrument Approach Procedure)

MISSED APPROACH SEGMENT— (See Segments of an Instrument Approach Procedure)

MLS—(See Microwave Landing System)

MLS CATEGORIES—

1. MLS Category I—An MLS approach procedure which provides for an approach to a height above touchdown of not less than 200 feet and a runway visual range of not less than 1,800 feet.
2. MLS Category II—Undefined until data gathering/analysis completion.
3. MLS Category III—Undefined until data gathering/analysis completion.

MODE— The letter or number assigned to a specific pulse spacing of radio signals transmitted or received by ground interrogator or airborne transponder components of the Air Traffic Control Radar Beacon System (ATCRBS). Mode A (military Mode 3) and Mode C (altitude reporting) are used in air traffic control. (See Transponder, Interrogator, Radar) (Refer to AIM)

ICAO—MODE (SSR MODE)— The letter or number assigned to a specific pulse spacing of the interrogation signals transmitted by an interrogator. There are 4 modes, A, B, C and D corresponding to four different interrogation pulse spacings.

MOVEMENT AREA— The runways, taxiways, and other areas of an airport/heliport which are utilized for taxiing/hover taxiing, air taxiing, takeoff, and landing of aircraft, exclusive of loading ramps and parking areas. At those airports/heliports with a tower, specific approval for entry onto the movement area must be obtained from ATC.

ICAO—MOVEMENT AREA— That part of an aerodrome intended for the surface movement of aircraft, including the maneuvering area and aprons.

MOVING TARGET INDICATOR/MTI— An electronic device which will permit radar scope presentation only from targets which are in motion. A partial remedy for ground clutter.

MSAW— (See Minimum Safe Altitude Warning)

MULTICOM— A mobile service not open to publis correspondence used to provide communications essential to conduct the activities being performed by or directed from private aircraft (FAR 87.277).

NAS STAGE A— The en route ATC system's radar, computers and computer programs, controller plan view displays (PVDs/Radar Scopes), input/output devices, and the related communications equipment which are integrated to form the heart of the automated IFR air traffic control system. This equipment performs Flight Data Processing (FDP) and Radar Data Processing (RDP). It interfaces with automated terminal systems and is used in the control of en route IFR aircraft. (Refer to AIM)

NATIONAL AIRSPACE SYSTEM/NAS— The common network of U.S. airspace; air navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information and services; rules, regulations and procedures, technical information, and manpower and material. Included are system components shared jointly with the military.

NATIONAL BEACON CODE ALLOCATION PLAN AIRSPACE/NBCAP AIRSPACE— Airspace over United States territory located within the North American continent between Canada and Mexico, including adjacent territorial waters outward to about boundaries of oceanic control areas (CTA)/Flight Information Regions (FIR). (See Flight Information Region)

NATIONAL FLIGHT DATA CENTER/NFDC— A facility in Washington D.C., established by FAA to operate a central aeronautical information service for the collection, validation, and dissemination of aeronautical data in support of the activities of government, industry, and the aviation community. The information is published in the National Flight Data Digest. (See National Flight Data Digest)

NATIONAL FLIGHT DATA DIGEST/NFDD— A daily (except weekends and Federal holidays) publication of flight information appropriate to aeronautical charts, aeronautical publications, Notices to Airmen, or other media serving the purpose of providing operational flight data essential to safe and efficient aircraft operations.

NATIONAL SEARCH AND RESCUE PLAN— An interagency agreement which provides for the effective utilization of all available facilities in all types of search and rescue missions.

NAVAID CLASSES— VOR, VORTAC, and TACAN aids are classed according to their operational use. The three classes of NAVAID's are:

T—Terminal.

L—Low altitude.

H—High altitude.

The normal service range for T, L, and H class aids is found in the AIM. Certain operational requirements make it necessary to use some of these aids at greater service ranges than specified. Extended range is made possible through flight inspection determinations. Some aids also have lesser service range due to location, terrain, frequency protection, etc. Restrictions to service range are listed in Airport/Facility Directory.

NAVIGABLE AIRSPACE— Airspace at and above the minimum flight altitudes prescribed in the FAR's including airspace needed for safe takeoff and landing. (Refer to FAR Part 91)

NAVIGATIONAL AID/NAVAID— Any visual or electronic device airborne or on the surface which provides point-to- point guidance information or position data to aircraft in flight. (See Air Navigation Facility)

NDB— (See Nondirectional Beacon)

NEGATIVE— "No," or "permission not granted," or "that is not correct."

NEGATIVE CONTACT— Used by pilots to inform ATC that:

1. Previously issued traffic is not in sight. It may be followed by the pilot's request for the controller to provide assistance in avoiding the traffic.
2. They were unable to contact ATC on a particular frequency.

NIGHT— The time between the end of evening civil twilight and the beginning of morning civil twilight, as published in the American Air Almanac, converted to local time.

ICAO—NIGHT— The hours between the end of evening civil twilight and the beginning of morning civil twilight or such other period between sunset and sunrise as may be specified by the appropriate authority.

NO GYRO APPROACH/VECTOR— A radar approach/vector provided in case of a malfunctioning gyro-compass or directional gyro. Instead of providing the pilot with headings to be flown, the controller observes the radar track and issues control instructions "turn right/left" or "stop turn" as appropriate. (Refer to AIM)

NONAPPROACH CONTROL TOWER— Authorizes aircraft to land or takeoff at the airport controlled by the tower or to transit the airport traffic area. The primary function of a nonapproach control tower is the sequencing of aircraft in the traffic pattern and on the landing area. Nonapproach control towers also separate aircraft operating under instrument flight rules clearances from approach controls and centers. They provide ground control services to aircraft, vehicles, personnel, and equipment on the airport movement area.

NONCOMPOSITE SEPARATION— Separation in accordance with minima other than the composite separation minimum specified for the area concerned.

NONDIRECTIONAL BEACON/RADIO BEACON/NDB— An L/MF or UHF radio beacon transmitting nondirectional signals whereby the pilot of an aircraft equipped with direction finding equipment can determine his bearing to or from the radio beacon and "home" on or track to or from the station. When the radio beacon is installed in conjunction with the Instrument Landing System marker, it is normally called a Compass Locator. (See Compass Locator, Automatic Direction Finder)

NONPRECISION APPROACH PROCEDURE/NONPRECISION APPROACH— A standard instrument approach procedure in which no electronic glide slope is provided; e.g., VOR, TACAN, NDB, LOC, ASR, LDA, or SDF approaches.

NONRADAR— Precedes other terms and generally means without the use of radar, such as:

1. Nonradar Route—A flight path or route over which the pilot is performing his own navigation. The pilot may be receiving radar separation, radar monitoring, or other ATC services while on a nonradar route. (See Radar Route)
2. Nonradar Approach—Used to describe instrument approaches for which course guidance on final approach is not provided by ground- based precision or surveillance radar. Radar vectors to the final approach course may or may not be provided by ATC. Examples of nonradar approaches are VOR, NDB, TACAN, and ILS/MLS approaches. (See Final Approach—IFR, Final Approach Course, Radar Approach, Instrument Approach Procedure)
3. Nonradar Separation—The spacing of aircraft in accordance with established minima without the use of radar; e.g., vertical, lateral, or longitudinal separation. (See Radar Separation)

ICAO—NonRadar Separation— The separation used when aircraft position information is derived from sources other than radar.

4. Nonradar Arrival—An arriving aircraft that is not being vectored to the final approach course for an instrument approach or towards the airport for a visual approach. The aircraft may or may not be in a radar environment and may or may not be receiving radar separation, radar monitoring, or other services provided by ATC. (See Radar Arrival, Radar Environment)

NONRADAR APPROACH CONTROL— An ATC facility providing approach control service without the use of radar. (See Approach Control, Approach Control Service)

NORDO— (See Lost Communications)

NORTH AMERICAN ROUTE— A numerically coded route preplanned over existing airway and route systems to and from specific coastal fixes serving the North Atlantic. North American Routes consist of the following:

1. Common Route/Portion—That segment of a North American Route between the inland navigation facility and the coastal fix.
2. Non-Common Route/Portion—That segment of a North American Route between the inland navigation facility and a designated North American terminal.
3. Inland Navigation Facility—A navigation aid on a North American Route at which the common route and/or the non-common route begins or ends.
4. Coastal Fix—A navigation aid or intersection where an aircraft transitions between the domestic route structure and the oceanic route structure.

NOTICES TO AIRMEN PUBLICATION— A publication designed primarily as a pilot's operational manual containing current NOTAM information considered essential to the safety of flight as well as supplemental data to other aeronautical publications. (See Notice to Airmen/NOTAM)

NOTICE TO AIRMEN/NOTAM— A notice containing information (not known sufficiently in advance to publicize by other means) concerning the establishment, condition, or change in any component (facility, service, or procedure of, or hazard in the National Airspace System) the timely knowledge of which is essential to personnel concerned with flight operations.

1. NOTAM(D)—A NOTAM given (in addition to local dissemination) distant dissemination via teletypewriter beyond the area of responsibility of the Flight Service Station. These NOTAM's will be stored and repeated hourly until canceled.

2. NOTAM(L)—A NOTAM given local dissemination by voice (teletypewriter where applicable) and a wide variety of means, such as telautograph, teleprinter, facsimile reproduction, hot line, telecopier, telegraph, and telephone, to satisfy local user requirements.

3. FDC NOTAM—A notice to airmen, regulatory in nature, transmitted by NFDC and given all-circuit dissemination.

ICAO—NOTAM— A notice, containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations.

NUMEROUS TARGETS VICINITY (LOCATION)— A traffic advisory issued by ATC to advise pilots that targets on the radar scope are too numerous to issue individually. (See Traffic Advisories)

OBSTACLE— An existing object, object of natural growth, or terrain at a fixed geographical location or which may be expected at a fixed location within a prescribed area with reference to which vertical clearance is or must be provided during flight operation.

OBSTRUCTION— Any object/obstacle exceeding the obstruction standards specified by FAR Part 77, Subpart C.

OBSTRUCTION LIGHT— A light or one of a group of lights, usually red or white, frequently mounted on a surface structure or natural terrain to warn pilots of the presence of an obstruction.

OFF-ROUTE VECTOR— A vector by ATC which takes an aircraft off a previously assigned route. Altitudes assigned by ATC during such vectors provide required obstacle clearance.

OFFSET PARALLEL RUNWAYS— Staggered runways having centerlines which are parallel.

ON COURSE—

1. Used to indicate that an aircraft is established on the route centerline.

2. Used by ATC to advise a pilot making a radar approach that his aircraft is lined up on the final approach course. (See On-Course Indication)

ON-COURSE INDICATION— An indication on an instrument, which provides the pilot a visual means of determining that the aircraft is located on the centerline of a given navigational track, or an indication on a radar scope that an aircraft is on a given track.

OPTION APPROACH— An approach requested and conducted by a pilot which will result in either a touch-and-go, missed approach, low approach, stop-and-go, or full stop landing. (See Cleared for the Option) (Refer to AIM)

ORGANIZED TRACK SYSTEM— A moveable system of oceanic tracks that traverses the North Atlantic between Europe and North America the physical position of which is determined twice daily taking the best advantage of the winds aloft.

OUT— The conversation is ended and no response is expected.

OUTER AREA (associated with ARSA)— Nonregulatory airspace surrounding designated ARSA airports wherein ATC provides radar vectoring and sequencing on a full-time basis for all IFR and participating VFR aircraft. The service provided in the outer area is called ARSA service which includes: IFR/IFR—standard IFR separation; IFR/VFR—traffic advisories and conflict resolution; and VFR/VFR—traffic advisories and, as appropriate, safety alerts. The normal radius will be 20 nautical miles with some variations based on site-specific requirements. The outer area extends outward from the primary ARSA airport and extends from the lower limits of radar/radio coverage up to the ceiling of the approach control's delegated airspace excluding the ARSA and other airspace as appropriate. (See Controlled Airspace—Airport Radar Service Area / ARSA, Conflict Resolution)

OUTER COMPASS LOCATOR— (See Compass Locator)

OUTER FIX— A general term used within ATC to describe fixes in the terminal area, other than the final approach fix. Aircraft are normally cleared to these fixes by an Air Route Traffic Control Center or an Approach Control Facility. Aircraft are normally cleared from these fixes to the final approach fix or final approach course.

OUTER MARKER/OM— A marker beacon at or near the glide slope intercept altitude of an ILS approach. It is keyed to transmit two dashes per second on a 400 Hz tone, which is received aurally and visually by compatible airborne equipment. The OM is normally located four to seven miles from the runway threshold on the extended centerline of the runway. (See Marker Beacon, Instrument Landing System) (Refer to AIM)

OVER— My transmission is ended; I expect a response.

OVERHEAD APPROACH/360 OVERHEAD— A series of predetermined maneuvers prescribed for VFR arrival of military aircraft (often in formation) for entry into the VFR traffic pattern and to proceed to a landing. The pattern usually specifies the following:

1. The radio contact required of the pilot.

2. The speed to be maintained.

3. An initial approach 3 to 5 miles in length.

4. An elliptical pattern consisting of two 180 degree turns.

5. A break point at which the first 180 degree turn is started.

6. The direction of turns.

7. Altitude (at least 500 feet above the conventional pattern).

8. A "Roll-out" on final approach not less than 1/4 mile from the landing threshold and not less than 300 feet above the ground.

PAN-PAN— The international radio-telephony urgency signal. When repeated three times, indicates uncertainty or alert followed by nature of urgency. (See MAYDAY) (Refer to AIM)

PARALLEL ILS/MLS APPROACHES— Approaches to parallel runways by IFR aircraft which, when established inbound toward the airport on the adjacent final approach courses, are radar-separated by at least 2 miles. (See Final Approach Course, Simultaneous ILS/MLS Approaches).

PARALLEL OFFSET ROUTE— A parallel track to the left or right of the designated or established airway/route. Normally associated with Area Navigation (RNAV) operations. (See Area Navigation)

PARALLEL RUNWAYS— Two or more runways at the same airport whose centerlines are parallel. In addition to runway number, parallel runways are designated as L (left) and R (right) or, if three parallel runways exist, L (left), C (center), and R (right).

PERMANENT ECHO— Radar signals reflected from fixed objects on the earth's surface; e.g., buildings, towers, terrain. Permanent echoes are distinguished from "ground clutter' by being definable locations rather than large areas. Under certain conditions they may be used to check radar alignment.

PHOTO RECONNAISSANCE (PR)— Military activity that requires locating individual photo targets and navigating to the targets at a preplanned angle and altitude. The activity normally requires a lateral route width of 16NM and altitude range of 1,500 feet to 10,000 feet AGL.

PILOT BRIEFING/PRE-FLIGHT PILOT BRIEFING— A service provided by the FSS to assist pilots in flight planning. Briefing items may include weather information, NOTAMS, military activities, flow control information, and other items as requested. (Refer to AIM)

PILOT IN COMMAND— The pilot responsible for the operation and safety of an aircraft during flight time. (Refer to FAR Part 91)

PILOTS AUTOMATIC TELEPHONE WEATHER ANSWERING SERVICE/PATWAS— A continuous telephone recording containing current and forecast weather information for pilots. (See Flight Service Station) (Refer to AIM)

PILOT'S DISCRETION— When used in conjunction with altitude assignments, means that ATC has offered the pilot the option of starting climb or descent whenever he wishes and conducting the climb or descent at any rate he wishes. He may temporarily level off at any intermediate altitude. However, once he has vacated an altitude, he may not return to that altitude.

PILOT WEATHER REPORT/PIREP— A report of meteorological phenomena encountered by aircraft in flight. (Refer to AIM)

POSITION REPORT/PROGRESS REPORT— A report over a known location as transmitted by an aircraft to ATC. (Refer to AIM)

POSITION SYMBOL— A computer-generated indication shown on a radar display to indicate the mode of tracking.

POSITIVE CONTROL— The separation of all air traffic within designated airspace by air traffic control. (See Positive Control Area)

POSITIVE CONTROL AREA/PCA— (See Controlled Airspace)

PRACTICE INSTRUMENT APPROACH— An instrument approach procedure conducted by a VFR or an IFR aircraft for the purpose of pilot training or proficiency demonstrations.

PRECIPITATION— Any or all forms of water particles (rain, sleet, hail, or snow) that fall from the atmosphere and reach the surface.

PRECISION APPROACH PROCEDURE/PRECISION APPROACH— A standard instrument approach procedure in which an electronic glideslope/glidepath is provided; e.g., ILS/MLS and PAR. (See Instrument Landing System, Microwave Landing System, Precision Approach Radar)

PRECISION APPROACH RADAR/PAR— Radar equipment in some ATC facilities operated by the FAA and/or the military services at joint-use civil/military locations and separate military installations to detect and display azimuth, elevation, and range of aircraft on the final approach course to a runway. This equipment may be used to monitor certain nonradar approaches, but is primarily used to conduct a precision instrument approach (PAR) wherein the controller issues guidance instructions to the pilot based on the aircraft's position in relation to the final approach course (azimuth), the glidepath (elevation), and the distance (range) from the touchdown point on the runway as displayed on the radar scope. (See Glidepath, PAR) (Refer to AIM)

The abbreviation "PAR" is also used to denote preferential arrival routes in ARTCC computers. (See Preferential Routes)

ICAO-PRECISION APPROACH RADAR/PAR—Primary radar equipment used to determine the position of an aircraft during final approach, in terms of lateral and vertical deviations relative to a nominal approach path, and in range relative to touchdown.

PREFERENTIAL ROUTES— Preferential routes (PDR's, PAR's, and PDAR's) are adapted in ARTCC computers to accomplish inter/intrafacility controller coordination and to assure that flight data is posted at the proper control positions. Locations having a need for these specific inbound and outbound routes normally publish such routes in local facility bulletins, and their use by pilots minimizes flight plan route amendments. When the workload or traffic situation permits, controllers normally provide radar vectors or assign requested routes to minimize circuitous routing. Preferential routes are usually confined to one ARTCC's area and are referred to by the following names or acronyms:

1. Preferential Departure Route/PDR—A specific departure route from an airport or terminal area to an en route point where there is no further

need for flow control. It may be included in a Standard Instrument Departure (SID) or a Preferred IFR Route.

2. Preferential Arrival Route/PAR—A specific arrival route from an appropriate en route point to an airport or terminal area. It may be included in a Standard Terminal Arrival (STAR) or a Preferred IFR Route. The abbreviation "PAR" is used primarily within the ARTCC and should not be confused with the abbreviation for Precision Approach Radar.

3. Preferential Departure and Arrival Route/PDAR—A route between two terminals which are within or immediately adjacent to one ARTCC's area. PDAR's are not synonomous with Preferred IFR Routes but may be listed as such as they do accomplish essentially the same purpose. (See Preferred IFR Routes, NAS Stage A)

PREFERRED IFR ROUTES— Routes established between busier airports to increase system efficiency and capacity. They normally extend through one or more ARTCC areas and are designed to achieve balanced traffic flows among high density terminals. IFR clearances are issued on the basis of these routes except when severe weather avoidance procedures or other factors dictate otherwise. Preferred IFR Routes are listed in the Airport/Facility Directory. If a flight is planned to or from an area having such routes but the departure or arrival point is not listed in the Airport/Facility Directory, pilots may use that part of a Preferred IFR Route which is appropriate for the departure or arrival point that is listed. Preferred IFR Routes are correlated with SID's and STAR's and may be defined by airways, jet routes, direct routes between NAVAID's, Waypoints, NAVAID radials/DME, or any combinations thereof. (See Standard Instrument Departure, Standard Terminal Arrival, Preferential Routes, Center's Area) (Refer to Airport/Facility Directory and Notices to Airmen Publication)

PREVAILING VISIBILITY— (See Visibility)

PROCEDURE TURN INBOUND— That point of a procedure turn maneuver where course reversal has been completed and an aircraft is established inbound on the intermediate approach segment or final approach course. A report of "procedure turn inbound" is normally used by ATC as a position report for separation purposes. (See Final Approach Course, Procedure Turn, Segments of an Instrument Approach Procedure)

PROCEDURE TURN/PT— The maneuver prescribed when it is necessary to reverse direction to establish an aircraft on the intermediate approach segment or final approach course. The outbound course, direction of turn, distance within which the turn must be completed, and minimum altitude are specified in the procedure. However, unless otherwise restricted, the point at which the turn may be commenced and the type and rate of turn are left to the discretion of the pilot.

ICAO—PROCEDURE TURN— A maneuver in which a turn is made away from a designated track followed by a turn in the opposite direction, both turns being executed so as to permit the aircraft to intercept and proceed along the reciprocal of the designated track.

PROFILE DESCENT— An uninterrupted descent (except where level flight is required for speed adjustment; e.g., 250 knots at 10,000 feet MSL) from cruising altitude/level to interception of a glide slope or to a minimum altitude specified for the initial or intermediate approach segment of a nonprecision instrument approach. The profile descent normally terminates at the approach gate or where the glide slope or other appropriate minimum altitude is intercepted.

PROGRAMMABLE INDICATOR DATA PROCESSOR/PIDP— The PIDP is a modification to the AN/TPX-42 interrogator system currently installed in fixed RAPCON's. The PIDP detects, tracks, and predicts secondary radar aircraft targets. These are displayed by means of computer-generated symbols and alphanumeric characters depicting flight identification, aircraft altitude, ground speed, and flight plan data. Although primary radar targets are not tracked, they are displayed coincident with the secondary radar targets as well as with the other symbols and alphanumerics. The system has the capability of interfacing with ARTCC's.

PROHIBITED AREA— (See Special Use Airspace).

ICAO—PROHIBITED AREA— An airspace of defined dimensions, above the land areas or territorial waters of a State, within which the flight of aircraft is prohibited.

PROPOSED BOUNDARY CROSSING TIME/PBCT— Each center has a PBCT parameter for each internal airport. Proposed internal flight plans are transmitted to the adjacent center if the flight time along the proposed route from the departure airport to the center boundary is less than or equal to the value of PBCT or if airport adaptation specifies transmission regardless of PBCT.

PUBLISHED ROUTE— A route for which an IFR altitude has been established and published; e.g., Federal Airways, Jet Routes, Area Navigation Routes, Specified Direct Routes.

QUADRANT— A quarter part of a circle, centered on a NAVAID, oriented clockwise from magnetic north as follows: NE quadrant 000-089, SE quadrant 090-179, SW quadrant 180-269, NW quadrant 270-359.

QUICK LOOK— A feature of NAS Stage A and ARTS which provides the controller the capability to display full data blocks of tracked aircraft from other control positions.

QUOTA FLOW CONTROL/QFLOW— A flow control procedure by which the Central Flow Control Function (CFCF) restricts traffic to the ARTC Center area having an impacted airport, thereby avoiding sector/area saturation. (See Air Traffic Control Systems Command Center) (Refer to Airport/Facility Directory)

RADAR/RADIO DETECTION AND RANGING— A device which, by measuring the time interval between transmission and reception of radio pulses and correlating the angular orientation of the radiated antenna beam or beams in azimuth and/or elevation, provides information on range, azimuth, and/or elevation of objects in the path of the transmitted pulses.

1. Primary Radar—A radar system in which a minute portion of a radio pulse transmitted from a site is reflected by an object and then received back at that site for processing and display at an air traffic control facility.
2. Secondary Radar/Radar Beacon/ATCRBS—A radar system in which the object to be detected is fitted with cooperative equipment in the form of a radio receiver/transmitter (transponder). Radar pulses transmitted from the searching transmitter/receiver (interrogator) site are received in the cooperative equipment and used to trigger a distinctive transmission from the transponder. This reply transmission, rather than a reflected signal, is then received back at the transmitter/receiver site for processing and display at an air traffic control facility. (See Transponder, Interrogator) (Refer to AIM)

ICAO—RADAR— A radio detection device which provides information on range, azimuth, and/or elevation of objects.

1. Primary Radar—A radar system which uses reflected radio signals.
2. Secondary Radar—A radar system wherein a radio signal transmitted from a radar station initiates the transmission of a radio signal from another station.

RADAR ADVISORY— The provision of advice and information based on radar observations. (See Advisory Service)

RADAR APPROACH— An instrument approach procedure which utilizes Precision Approach Radar (PAR) or Airport Surveillance Radar (ASR). (See PAR Approach, Surveillance Approach, Airport Surveillance Radar, Precision Approach Radar, Instrument Approach Procedure) (Refer to AIM)

ICAO—RADAR APPROACH— An approach, executed by an aircraft, under the direction of a radar controller.

RADAR APPROACH CONTROL FACILITY— A terminal ATC facility that uses radar and nonradar capabilities to provide approach control services to aircraft arriving, departing, or transiting airspace controlled by the facility (see Approach Control Service). Provides radar ATC services to aircraft operating in the vicinity of one or more civil and/ or military airports in a terminal area. The facility may provide services of a ground controlled approach (GCA); i.e., ASR and PAR approaches. A radar approach control facility may be operated by FAA, USAF, US Army, USN, USMC, or jointly by FAA and a military service. Specific facility nomenclatures are used for administrative purposes only and are related to the physical location of the facility and the operating service generally as follows:

Army Radar Approach Control/ARAC (Army).

Radar Air Traffic Control Facility/ RATCF (Navy/FAA).

Radar Approach Control/RAPCON (Air Force/FAA).

Terminal Radar Approach Control/TRACON (FAA).

Tower/Airport Traffic Control Tower/ATCT (FAA). (Only those towers delegated approach control authority.)

RADAR ARRIVAL— An arriving aircraft which is being vectored to the final approach course for an instrument approach or toward the airport for a visual approach. (See Radar Approach, Visual Approach)

RADAR BEACON— (See Radar)

RADAR CONTACT—

1. Used by ATC to inform an aircraft that it is identified on the radar display and radar flight following will be provided until radar identification is terminated. Radar service may also be provided within the limits of necessity and capability. When a pilot is informed of "radar contact," he automatically discontinues reporting over compulsory reporting points. (See Radar Flight Following, Radar Contact Lost, Radar Service, Radar Service Terminated). (Refer to AIM)
2. The term used to inform the controller that the aircraft is identified and approval is granted for the aircraft to enter the receiving controllers airspace.

ICAO—RADAR CONTACT— The situation which exists when the radar blip of a particular aircraft is seen and identified on a radar display.

RADAR CONTACT LOST— Used by ATC to inform a pilot that radar identification of his aircraft has been lost. The loss may be attributed to several things including the aircraft's merging with weather or ground clutter, the aircraft's flying below radar line of sight, the aircraft's entering an area of poor radar return, or a failure of the aircraft transponder or the ground radar equipment. (See Clutter, Radar Contact)

RADAR ENVIRONMENT— An area in which radar service may be provided. (See Radar Contact, Radar Service, Additional Services, Traffic Advisories)

RADAR FLIGHT FOLLOWING— The observation of the progress of radar identified aircraft, whose primary navigation is being provided by the pilot, wherein the controller retains and correlates the aircraft identity with the appropriate target or target symbol displayed on the radar scope. (See Radar Contact, Radar Service) (Refer to AIM)

RADAR IDENTIFICATION— The process of ascertaining that an observed radar target is the radar return from a particular aircraft. (See Radar Contact, Radar Service)

*ICAO—RADAR IDENTIFICATION—*The process of correlating a particular radar blip with a specific aircraft.

RADAR IDENTIFIED AIRCRAFT— An aircraft, the position of which has been correlated with an observed target or symbol on the radar display. (See Radar Contract, Radar Contact Lost)

RADAR MONITORING— (See Radar Service)

RADAR NAVIGATIONAL GUIDANCE— (See Radar Service)

RADAR POINT OUT/POINT OUT— Used between controllers to indicate radar handoff action where the initiating controller plans to retain communications with an aircraft penetrating the other controller's airspace and additional coordination is required.

RADAR ROUTE— A flight path or route over which an aircraft is vectored. Navigational guidance and altitude assignments are provided by ATC. (See Flight Path, Route)

RADAR SEPARATION— (See Radar Service)

RADAR SERVICE— A term which encompasses one or more of the following services based on the use of radar which can be provided by a controller to a pilot of a radar identified aircraft.

1. Radar Separation.—Radar spacing of aircraft in accordance with established minima.

ICAO—RADAR SEPARATION— The separation used when aircraft position information is derived from radar sources.

2. Radar Navigational Guidance.—Vectoring aircraft to provide course guidance.
3. Radar Monitoring.—The radar flight-following of aircraft, whose primary navigation is being performed by the pilot, to observe and note deviations from its authorized flight path, airway, or route. When being applied specifically to radar monitoring of instrument approaches; i.e., with precision approach radar (PAR) or radar monitoring of simultaneous ILS/MLS approaches, it includes advice and instructions whenever an aircraft nears or exceeds the prescribed PAR safety limit or simultaneous ILS/MLS no transgression zone. (See Additional Services, Traffic Advisories)

ICAO—RADAR MONITORING— The use of radar for the purpose of providing aircraft with information and advice relative to significant deviations from nominal flight path.

ICAO—RADAR SERVICE— Term used to indicate a service provided directly by means of radar.

RADAR SERVICE TERMINATED— Used by ATC to inform a pilot that he will no longer be provided any of the services that could be received while in radar contact. Radar service is automatically terminated, and the pilot is not advised in the following cases:

1. An aircraft cancels its IFR flight plan, except within a TCA, TRSA, ARSA, or where Stage II service is provided.
2. An aircraft conducting an instrument, visual, or contact approach has landed or has been instructed to change to advisory frequency.
3. An arriving VFR aircraft, receiving radar service to a tower-controlled airport within a TCA, TRSA, ARSA, or where Stage II service is provided, has landed; or to all other airports, is instructed to change to tower or advisory frequency.
4. An aircraft completes a radar approach.

RADAR SURVEILLANCE— The radar observation of a given geographical area for the purpose of performing some radar function.

RADAR TRAFFIC ADVISORIES— (See Traffic Advisories)

RADAR TRAFFIC INFORMATION SERVICE— (See Traffic Advisories)

RADAR WEATHER ECHO INTENSITY LEVELS— Existing radar systems cannot detect turbulence. However, there is a direct correlation between the degree of turbulence and other weather features associated with thunderstorms and the radar weather echo intensity. The National Weather Service has categorized six levels of radar weather echo intensity. The levels are sometimes expressed during communications as "VIP LEVEL" 1 through 6 (derived from the component of the weather radar that produces the information—Video Integrator and Processor). The following list gives the weather features likely to be associated with these levels during thunderstorm weather situations:

1. Level 1 (WEAK) and Level 2 (MODERATE). Light to moderate turbulence is possible with lightning.
2. Level 3 (STRONG). Severe turbulence possible, lightning.
3. Level 4 (VERY STRONG). Severe turbulence likely, lightning.
4. Level 5 (INTENSE). Severe turbulence, lightning, organized wind gusts, hail likely.
5. Level 6 (EXTREME). Severe turbulence, large hail, lightning, extensive wind gusts, and turbulence.

RADIAL— A magnetic bearing extending from a VOR/VORTAC/TACAN navigation facility.

RADIO—

1. A device used for communication.
2. Used to refer to a flight service station; e.g., "Seattle Radio" is used to call Seattle FSS.

RADIO ALTIMETER/RADAR ALTIMETER— Aircraft equipment which makes use of the reflection of radio waves from the ground to determine the height of the aircraft above the surface.

RADIO BEACON— (See Nondirectional Beacon)

RADIO MAGNETIC INDICATOR/RMI— An aircraft navigational instrument coupled with a gyro compass or similar compass that indicates the direction of a selected NAVAID and indicates bearing with respect to the heading of the aircraft.

RAMP— (See Apron)

READ BACK— Repeat my message back to me.

RECEIVING CONTROLLER/FACILITY— A controller/facility receiving control of an aircraft from another controller/facility.

REDUCE SPEED TO (SPEED)— (See Speed Adjustment)

RELEASE TIME— A departure time restriction issued to a pilot by ATC (either directly or through an authorized relay) when necessary to separate a departing aircraft from other traffic.

*ICAO—RELEASE TIME—*Time prior to which an aircraft should be given further clearance or prior to which it should not proceed in case of radio failure.

REMOTE COMMUNICATIONS AIR/GROUND FACILITY/RCAG— An unmanned VHF/UHF transmitter/receiver facility which is used to expand ARTCC air/ground communications coverage and to facilitate direct contact between pilots and controllers. RCAG facilities are sometimes not equipped with emergency frequencies 121.5 MHz and 243.0 MHz. (Refer to AIM)

REMOTE COMMUNICATIONS OUTLET/RCO AND REMOTE TRANSMITTER/RECEIVER/RTR— An unmanned communications facility remotely controlled by air traffic personnel. RCO's serve FSS's. RTR's serve terminal ATC facilities. An RCO or RTR may be UHF or VHF and will extend the communication range of the air traffic facility. There are several classes of RCO's and RTR's. The class is determined by the number of transmitters or receivers. Classes A through G are used primarily for air/ground purposes. RCO and RTR class O facilities are nonprotected outlets subject to undetected and prolonged outages. RCO (O's) and RTR (O's) were established for the express purpose of providing ground-to-ground communications between air traffic control specialists and pilots located at a satellite airport for delivering en route clearances, issuing departure authorizations, and acknowledging instrument flight rules cancellations or departure/landing times. As a secondary function, they may be used for advisory purposes whenever the aircraft is below the coverage of the primary air/ground frequency.

REMOTE TRANSMITTER/RECEIVER/RTR— (See Remote Communications Outlet)

REPORT— Used to instruct pilots to advise ATC of specified information; e.g., "Report passing Hamilton VOR."

REPORTING POINT— A geographical location in relation to which the position of an aircraft is reported. (See Compulsory Reporting Point) (Refer to AIM)

ICAO—REPORTING POINT— A specified geographical location in relation to which the position of an aircraft can be reported.

REQUEST FULL ROUTE CLEARANCE/FRC— Used by pilots to request that the entire route of flight be read verbatim in an ATC clearance. Such request should be made to preclude receiving an ATC clearance based on the original filed flight plan when a filed IFR flight plan has been revised by the pilot, company, or operations prior to departure.

RESCUE COORDINATION CENTER/RCC— A search and rescue (SAR) facility equipped and manned to coordinate and control SAR operations in an area designated by the SAR plan. The U.S. Coast Guard and the U.S. Air Force have responsibility for the operation of RCC's.

ICAO—RESCUE CO-ORDINATION CENTRE— A unit responsible for promoting efficient organization of search and rescue service and for co-ordinating the conduct of search and rescue operations within a search and rescue region.

RESTRICTED AREA— (See Special Use Airspace).

*ICAO—RESTRICTED AREA—*Airspace of defined dimensions, above the land areas or territorial waters of a State, within which the flight of aircraft is restricted in accordance with certain specified conditions.

RESUME OWN NAVIGATION— Used by ATC to advise a pilot to resume his own navigational responsibility. It is issued after completion of a radar vector or when radar contact is lost while the aircraft is being radar vectored. (See Radar Contact Lost, Radar Service Terminated)

RNAV— (See Area Navigation)

RNAV APPROACH— An instrument approach procedure which relies on aircraft area navigation equipment for navigational guidance. (See Instrument Approach Procedure, Area Navigation)

ROAD RECONNAISSANCE (RC)— Military activity requiring navigation along roads, railroads, and rivers. Reconnaissance route/route segments are seldom along a straight line and normally require a lateral route width of 10NM to 30NM and an altitude range of 500 feet to 10,000 feet AGL.

ROGER— I have received all of your last transmission. It should not be used to answer a question requiring a yes or a no answer. (See Affirmative, Negative)

ROLLOUT RVR— (See Visibility)

ROUTE— A defined path, consisting of one or more courses in a horizontal plane, which aircraft traverse over the surface of the earth. (See Airway, Jet Route, Published Route, Unpublished Route)

ROUTE SEGMENT— As used in Air Traffic Control, a part of a route that can be defined by two navigational fixes, two NAVAID's, or a fix and a NAVAID. (See Fix, Route)

*ICAO—ROUTE SEGMENT—*A portion of a route to be flown, as defined by two consecutive significant points specified in a flight plan.

RUNWAY— A defined rectangular area on a land airport prepared for the landing and takeoff run of aircraft along its length. Runways are normally numbered in relation to their magnetic direction rounded off to the nearest 10 degrees; e.g., Runway 01, Runway 25. (See Parallel Runways)

*ICAO—RUNWAY—*A defined rectangular area, on a land aerodrome prepared for the landing and takeoff run of aircraft along its length.

RUNWAY CENTERLINE LIGHTING— (See Airport Lighting)

RUNWAY CONDITION READING/RCR— Numerical decelerometer readings relayed by air traffic controllers at USAF and certain civil bases for use by the pilot in determining runway braking action. These readings are routinely relayed only to USAF and Air National Guard Aircraft. (See Braking Action)

RUNWAY END IDENTIFIER LIGHTS— (See Airport Lighting)

RUNWAY GRADIENT— The average slope, measured in percent, between two ends or points on a runway. Runway gradient is depicted on Government aerodrome sketches when total runway gradient exceeds 0.3%.

RUNWAY HEADING— The magnetic direction indicated by the runway number. When cleared to "fly/maintain runway heading," pilots are expected to comply with the ATC clearance by flying the heading indicated by the runway number without applying any drift correction; e.g., Runway 4, 040° magnetic heading; Runway 20, 200° magnetic heading.

RUNWAY IN USE/ACTIVE RUNWAY/DUTY RUNWAY— Any runway or runways currently being used for takeoff or landing. When multiple runways are used, they are all considered active runways.

RUNWAY LIGHTS— (See Airport Lighting)

RUNWAY MARKINGS— (See Airport Marking Aids.)

RUNWAY PROFILE DESCENT— An instrument flight rules (IFR) air traffic control arrival procedure to a runway published for pilot use in graphic and/or textual form and may be associated with a STAR. Runway Profile Descents provide routing and may depict crossing altitudes, speed restrictions, and headings to be flown from the en route structure to the point where the pilot will receive clearance for and execute an instrument approach procedure. A Runway Profile Descent may apply to more than one runway if so stated on the chart. (Refer to AIM)

RUNWAY USE PROGRAM— A noise abatement runway selection plan designed to enhance noise abatement efforts with regard to airport communities for arriving and departing aircraft. These plans are developed into runway use programs and apply to all turbojet aircraft 12,500 pounds or heavier; turbojet aircraft less than 12,500 pounds are included only if the airport proprietor determines that the aircraft creates a noise problem. Runway use programs are coordinated with FAA offices, and safety criteria used in these programs are developed by the Office of Flight Operations. Runway use programs are administered by the Air Traffic Service as "Formal" or "Informal" programs.

1. Formal Runway Use Program—An approved noise abatement program which is defined and acknowledged in a Letter of Understanding between Flight Operations, Air Traffic Service, the airport proprietor, and the users. Once established, participation in the program is mandatory for aircraft operators and pilots as provided for in FAR 91.87.
2. Informal Runway Use Program—An approved noise abatement program which does not require a Letter of Understanding, and participation in the program is voluntary for aircraft operators/pilots.

RUNWAY VISIBILITY VALUE— (See Visibility)

RUNWAY VISUAL RANGE— (See Visibility)

SAFETY ALERT— A safety alert issued by ATC to aircraft under their control if ATC is aware the aircraft is at an altitude which, in the controller's judgment, places the aircraft in unsafe proximity to terrain, obstructions, or other aircraft. The controller may discontinue the issuance of further alerts if the pilot advises he is taking action to correct the situation or has the other aircraft in sight.

1. Terrain/Obstruction Alert—A safety alert issued by ATC to aircraft under their control if ATC is aware the aircraft is at an altitude which, in the controller's judgment, places the aircraft in unsafe proximity to terrain/obstructions; e.g., "Low Altitude Alert, check your altitude immediately."
2. Aircraft Conflict Alert—A safety alert issued by ATC to aircraft under their control if ATC is aware of an aircraft that is not under their control at an altitude which, in the controller's judgment, places both aircraft in unsafe proximity to each other. With the alert, ATC will offer the pilot an alternate course of action when feasible; e.g., "Traffic Alert, advise you turn right heading zero niner zero or climb to eight thousand immediately."

The issuance of a safety alert is contingent upon the capability of the controller to have an awareness of an unsafe condition. The course of action provided will be predicated on other traffic under ATC control. Once the alert is issued, it is solely the pilot's prerogative to determine what course of action, if any, he will take.

SAIL BACK— A maneuver during high wind conditions (usually with power off) where float plane movement is controlled by water rudders/opening and closing cabin doors.

SAY AGAIN— Used to request a repeat of the last transmission. Usually specifies transmission or portion thereof not understood or received; e.g., "Say again all after ABRAM VOR."

SAY ALTITUDE— Used by ATC to ascertain an aircraft's specific altitude/flight level. When the aircraft is climbing or descending, the pilot should state the indicated altitude rounded to the nearest 100 feet.

SAY HEADING— Used by ATC to request an aircraft heading. The pilot should state the actual heading of the aircraft.

SEA LANE— A designated portion of water outlined by visual surface markers for and intended to be used by aircraft designed to operate on water.

SEARCH AND RESCUE FACILITY— A facility responsible for maintaining and operating a search and rescue (SAR) service to render aid to persons and property in distress. It is any SAR unit, station, NET, or other operational activity which can be usefully employed during an SAR Mission; e.g., a Civil Air Patrol Wing, or a Coast Guard Station. (See Search and Rescue)

SEARCH AND RESCUE/SAR— A service which seeks missing aircraft and assists those found to be in need of assistance. It is a cooperative effort using the facilities and services of available Federal, state and local agencies. The U.S. Coast Guard is responsible for coordination of search and rescue for the Maritime Region, and the U.S. Air Force is responsible for search and rescue for the Inland Region. Information pertinent to search and rescue should be passed through any air traffic facility or be transmitted directly to the Rescue Coordination Center by telephone. (See Flight Service Station, Rescue Coordination Center) (Refer to AIM)

SEE AND AVOID— A visual procedure wherein pilots of aircraft flying in visual meteorological conditions (VMC), regardless of type of flight plan, are charged with the responsibility to observe the presence of other aircraft and to maneuver their aircraft as required to avoid the other aircraft. Right-of-way rules are contained in FAR, Part 91. (See Instrument Flight Rules, Visual Flight Rules, Visual Meteorological Conditions, Instrument Meteorological Conditions)

SEGMENTED CIRCLE— A system of visual indicators designed to provide traffic pattern information at airports without operating control towers. (Refer to AIM)

SEGMENTS OF AN INSTRUMENT APPROACH PROCEDURE— An instrument approach procedure may have as many as four separate segments depending on how the approach procedure is structured.

1. Initial Approach—The segment between the initial approach fix and the intermediate fix or the point where the aircraft is established on the intermediate course or final approach course.
2. Intermediate Approach—The segment between the intermediate fix or point and the final approach fix.
3. Final Approach—The segment between the final approach fix or point and the runway, airport, or missed approach point.
4. Missed Approach—The segment between the missed approach point or the point of arrival at decision height and the missed approach fix at the prescribed altitude. (Refer to FAR, Part 97)

ICAO

1. *Initial Approach*—That part of an instrument approach procedure consisting of the first approach to the first navigational facility associated with the procedure, or to a predetermined fix.
2. *Intermediate Approach*—That part of an instrument approach procedure from the first arrival at the first navigational facility or predetermined fix, to the beginning of the final approach.
3. *Final Approach*—That part of an instrument approach procedure from the time the aircraft has:
   a. Completed the last procedure turn or base turn where one is specified, or
   b. Crossed a specified fix, or
   c. Intercepted the last track specified for the procedures until it has crossed a point in the vicinity of an aerodrome from which:
   (1) A landing can be made, or
   (2) A missed approach procedure is initiated.
4. *Missed Approach Procedure*—The procedure to be followed if, after an instrument approach, a landing is not effected and occurring normally:
   a. When the aircraft has descended to the decision height and has not established visual contact, or
   b. When directed by air traffic control to pull up or to go around again.

SEPARATION— In air traffic control, the spacing of aircraft to achieve their safe and orderly movement in flight and while landing and taking off. (See Separation Minima)

ICAO—SEPARATION—Spacing between aircraft, levels or tracks.

SEPARATION MINIMA— The minimum longitudinal, lateral, or vertical distances by which aircraft are spaced through the application of air traffic control procedures. (See Separation)

SEVERE WEATHER AVOIDANCE PLAN/SWAP— An approved plan to minimize the affect of severe weather on traffic flows in impacted terminal and/or ARTCC areas. SWAP is normally implemented to provide the least disruption to the ATC system when flight through portions of airspace is difficult or impossible due to severe weather.

SHORT RANGE CLEARANCE— A clearance issued to a departing IFR flight which authorizes IFR flight to a specific fix short of the destination while air traffic control facilities are coordinating and obtaining the complete clearance.

SHORT TAKEOFF AND LANDING AIRCRAFT/STOL AIRCRAFT— An aircraft which, at some weight within its approved operating weight, is capable of operating from a STOL runway in compliance with the applicable STOL characteristics, airworthiness, operations, noise, and pollution standards. (See Vertical Takeoff and Landing Aircraft)

SIDESTEP MANEUVER— A visual maneuver accomplished by a pilot at the completion of an instrument approach to permit a straight-in landing on a parallel runway not more than 1,200 feet to either side of the runway to which the instrument approach was conducted. (Refer to AIM)

***SIGMET* /WS/SIGNIFICANT METEOROLOGICAL INFORMATION—** A weather advisory issued concerning weather significant to the safety of all aircraft. SIGMET advisories cover severe and extreme turbulence, severe icing, and widespread dust or sandstorms that reduce visibility to less than 3 miles. (See Convective SIGMET, CWA, and AIRMET) (Refer to AIM).

ICAO—SIGMET INFORMATION— Information prepared by a meteorological watch office regarding the occurrence or expected occurrence of one or more of the following phenomena:

1. At subsonic cruising levels:

   Active thunderstorm area.
   Tropical revolving storm.
   Severe line squall.
   Heavy hail.
   Severe turbulence.
   Severe icing.
   Marked mountain waves.
   Widespread sandstorm/duststorm.

2. At transonic levels and supersonic cruising levels:

   Moderate or severe turbulence.
   Cumulonimbus clouds.
   Hail.

SIMPLIFIED DIRECTIONAL FACILITY/SDF— A NAVAID used for nonprecision instrument approaches. The final approach course is similar to that of an ILS localizer except that the SDF course may be offset from the runway, generally not more than 3 degrees, and the course may be wider than the localizer, resulting in a lower degree of accuracy. (Refer to AIM)

SIMULATED FLAMEOUT/SFO— A practice approach by a jet aircraft (normally military) at idle thrust to a runway. The approach may start at a relatively high altitude over a runway (high key) and may continue on a relatively high and wide downwind leg with a high rate of descent and a continuous turn to final. It terminates in a landing or low approach. The purpose of this approach is to simulate a flameout. (See Flameout)

SIMULTANEOUS ILS/MLS APPROACHES— An approach system permitting simultaneous ILS/MLS approaches to airports having parallel runways separated by at least 4,300 feet between centerlines. Integral parts of a total system are ILS/MLS, radar, communications, ATC procedures, and appropriate airborne equipment. (See Parallel Runways) (Refer to AIM)

SINGLE DIRECTION ROUTES— Preferred IFR Routes which are sometimes depicted on high altitude en route charts and which are normally flown in one direction only. (See Preferred IFR Route) (Refer to Airport/Facility Directory)

SINGLE FREQUENCY APPROACH/SFA— A service provided under a letter of agreement to military single-piloted turbojet aircraft which permits use of a single UHF frequency during approach for landing. Pilots will not normally be required to change frequency from the beginning of the approach to touchdown except that pilots conducting an en route descent are required to change frequency when control is transferred from the air route traffic control center to the terminal facility. The abbreviation "SFA" in the DOD FLIP IFR Supplement under "Communications" indicates this service is available at an aerodrome.

SINGLE-PILOTED AIRCRAFT— A military turbojet aircraft possessing one set of flight controls, tandem cockpits, or two sets of flight controls but operated by one pilot is considered single-piloted by ATC when determining the appropriate air traffic service to be applied. (See Single Frequency Approach)

SLASH— A radar beacon reply displayed as an elongated target.

SLOW TAXI— To taxi a float plane at low power or low RPM.

SPEAK SLOWER— Used in verbal communications as a request to reduce speech rate.

SPECIAL EMERGENCY— A condition of air piracy or other hostile act by a person(s) aboard an aircraft which threatens the safety of the aircraft or its passengers.

SPECIAL IFR— (See Fixed-Wing Special IFR)

SPECIAL INSTRUMENT APPROACH PROCEDURE— (See Instrument Approach Procedure)

SPECIAL USE AIRSPACE— Airspace of defined dimensions identified by an area on the surface of the earth wherein activities must be confined because of their nature and/or wherein limitations may be imposed upon aircraft operations that are not a part of those activities. TYPES OF SPECIAL USE AIRSPACE:

1. Alert Area—Airspace which may contain a high volume of pilot training activities or an unusual type of aerial activity, neither of which is hazardous to aircraft. Alert Areas are depicted on aeronautical charts for the information of nonparticipating pilots. All activities within an Alert Area are conducted in accordance with Federal Aviation Regulations, and pilots of participating aircraft as well as pilots transiting the area are equally responsible for collision avoidance.

2. Controlled Firing Area—Airspace wherein activities are conducted under conditions so controlled as to eliminate hazards to nonparticipating aircraft and to ensure the safety of persons and property on the ground.

3. Military Operations Area (MOA)—An MOA is an airspace assignment of defined vertical and lateral dimensions established outside positive control areas to separate/segregate certain military activities from IFR traffic and to identify for VFR traffic where these activities are conducted. (Refer to AIM).

4. Prohibited Area—Designated airspace within which the flight of aircraft is prohibited. (Refer to En Route Charts, AIM).

5. Restricted Area—Airspace designated under FAR, Part 73, within which the flight of aircraft, while not wholly prohibited, is subject to restriction. Most restricted areas are designated joint use and IFR/VFR operations in the area may be authorized by the controlling ATC facility when it is not being utilized by the using agency. Restricted areas are depicted on en route charts.

Where joint use is authorized, the name of the ATC controlling facility is also shown. (Refer to FAR, Part 73 and AIM)

6. Warning Area—Airspace which may contain hazards to nonparticipating aircraft in international airspace.

SPECIAL VFR CONDITIONS— Weather conditions in a control zone which are less than basic VFR and in which some aircraft are permitted flight under Visual Flight Rules. (See Special VFR Operations) (Refer to FAR, Part 91)

SPECIAL VFR OPERATIONS— Aircraft operating in accordance with clearances within control zones in weather conditions less than the basic VFR weather minima. Such operations must be requested by the pilot and approved by ATC. (See Special VFR Conditions)

ICAO—SPECIAL VFR FLIGHT—A controlled VFR flight authorized by air traffic control to operate within a control zone under meteorological conditions below the visual meteorological conditions.

SPEED— (See Airspeed, Groundspeed)

SPEED ADJUSTMENT— An ATC procedure used to request pilots to adjust aircraft speed to a specific value for the purpose of providing desired spacing. Pilots are expected to maintain a speed of plus or minus 10 knots or 0.02 mach number of the specified speed.

Examples of speed adjustments are:

1. "Increase/reduce speed to mach point (number)."
2. "Increase/reduce speed to (speed in knots)" or "Increase/reduce speed (number of knots) knots."
3. "If practical, reduce speed to (speed);" or "If practical, reduce speed (number of knots."

SPEED BRAKES/DIVE BRAKES— Moveable aerodynamic devices on aircraft that reduce airspeed during descent and landing.

SQUAWK (Mode, Code, Function)— Activate specific modes/codes/functions on the aircraft transponder; e.g., "Squawk three/alpha, two one zero five, low." (See Transponder)

STAGE I/II/III SERVICE— (See Terminal Radar Program)

STANDARD INSTRUMENT APPROACH PROCEDURE/SIAP— (See Instrument Approach Procedure)

STANDARD INSTRUMENT DEPARTURE/SID— A preplanned instrument flight rule (IFR) air traffic control departure procedure printed for pilot use in graphic and/or textual form. SID's provide transition from the terminal to the appropriate en route structure. (See IFR Takeoff Minima and Departure Procedures) (Refer to AIM)

STANDARD RATE TURN— A turn of three degrees per second.

STANDARD TERMINAL ARRIVAL/STAR— A preplanned instrument flight rule (IFR) air traffic control arrival procedure published for pilot use in graphic and/or textual form. STAR's provide transition from the en route structure to an outer fix or an instrument approach fix/arrival waypoint in the terminal area.

STAND BY— Means the controller or pilot must pause for a few seconds, usually to attend to other duties of a higher priority. Also means to wait as in "stand by for clearance." If a delay is lengthy, the caller should reestablish contact.

STATIONARY RESERVATIONS— Altitude reservations which encompass activities in a fixed area. Stationary reservations may include activities, such as special tests of weapons systems or equipment, certain U.S. Navy carrier, fleet, and anti-submarine operations, rocket, missile and drone operations, and certain aerial refueling or similar operations.

STEPDOWN FIX— A fix permitting additional descent within a segment of an instrument approach procedure by identifying a point at which a controlling obstacle has been safely overflown.

STEP TAXI— To taxi a float plane at full power or high RPM.

STEP TURN— A maneuver used to put a float plane in a planing configuration prior to entering an active sea lane for takeoff. The STEP TURN maneuver should only be used upon pilot request.

STEREO ROUTE— A routinely used route of flight established by users and ARTCC's identified by a coded name; e.g., ALPHA 2. These routes minimize flight plan handling and communications.

STOP ALTITUDE SQUAWK— Used by ATC to inform an aircraft to turn-off the automatic altitude reporting feature of its transponder. It is issued when the verbally reported altitude varies 300 feet or more from the automatic altitude report. (See Altitude Readout, Transponder)

STOP AND GO— A procedure wherein an aircraft will land, make a complete stop on the runway, and then commence a takeoff from that point. (See Low Approach, Option Approach)

STOPOVER FLIGHT PLAN— A flight plan format which permits in a single submission the filing of a sequence of flight plans through interim full-stop destinations to a final destination.

STOP SQUAWK (Mode or Code)— Used by ATC to tell the pilot to turn specified functions of the aircraft transponder off. (See Stop Altitude Squawk, Transponder)

STOP STREAM/BURST/BUZZER— Used by ATC to request a pilot to suspend electronic countermeasure activity. (See Jamming)

STOPWAY— An area beyond the takeoff runway designated by the airport authorities as able to support an airplane during an aborted takeoff. (Refer to FAR, Part 1)

STRAIGHT-IN APPROACH—IFR— An instrument approach wherein final approach is begun without first having executed a procedure turn, not necessarily completed with a straight-in landing or made to straight-in landing minimums. (See Straight-in Landing, Landing Minimums, Straight-in Approach-VFR)

STRAIGHT-IN APPROACH—VFR— Entry into the traffic pattern by interception of the extended runway centerline (final approach course) without executing any other portion of the traffic pattern. (See Traffic Pattern)

STRAIGHT-IN LANDING— A landing made on a runway aligned within 30° of the final approach course following completion of an instrument approach. (See Straight-in Approach-IFR)

STRAIGHT-IN LANDING MINIMUMS/STRAIGHT-IN MINIMUMS— (See Landing Minimums)

SUBSTITUTE ROUTE— A route assigned to pilots when any part of an airway or route is unusable because of NAVAID status. These routes consist of:

1. Substitute routes which are shown on U.S. Government charts.
2. Routes defined by ATC as specific NAVAID radials or courses.
3. Routes defined by ATC as direct to or between NAVAID's.

SUNSET AND SUNRISE— The mean solar times of sunset and sunrise as published in the Nautical Almanac, converted to local standard time for the locality concerned. Within Alaska, the end of evening civil twilight and the beginning of morning civil twilight, as defined for each locality.

SUPER HIGH FREQUENCY/SHF—The frequency band between 3 and 30 gigahertz (gHz). The elevation and azimuth stations of the microwave landing system operate from 5031MHz to 5091MHz in this spectrum.

SURVEILLANCE APPROACH— An instrument approach wherein the air traffic controller issues instructions, for pilot compliance, based on aircraft position in relation to the final approach course (azimuth), and the distance (range) from the end of the runway as displayed on the controller's radar scope. The controller will provide recommended altitudes on final approach if requested by the pilot. (See PAR Approach) (Refer to AIM)

SYSTEM STRATEGIC NAVIGATION (SN)— Military activity accomplished by navigating along a preplanned route using internal aircraft systems to maintain a desired track. This activity normally requires a lateral route width of 10NM and altitude range of 1,000 feet to 6,000 feet AGL with some route segments that permit terrain following.

TACAN-ONLY AIRCRAFT— An aircraft, normally military, possessing TACAN with DME but no VOR navigational system capability. Clearances must specify TACAN or VORTAC fixes and approaches.

TACTICAL AIR NAVIGATION/TACAN— An ultrahigh frequency electronic rho-theta air navigation aid which provides suitably equipped aircraft a continuous indication of bearing and distance to the TACAN station. (See VORTAC) (Refer to AIM)

TARGET— The indication shown on a radar display resulting from a primary radar return or a radar beacon reply. (See Radar, Target Symbol)

*ICAO—TARGET—*In radar:

1. Generally, any discrete object which reflects or retransmits energy back to the radar equipment.
2. Specifically, an object of radar search or surveillance.

TARGET SYMBOL— A computer-generated indication shown on a radar display resulting from a primary radar return or a radar beacon reply.

TAXI— The movement of an airplane under its own power on the surface of an airport (FAR Part 135.100-Note). Also, it describes the surface movement of helicopters equipped with wheels. (See Air Taxi, Hover Taxi) (Refer to AIM)

TAXI INTO POSITION AND HOLD— Used by ATC to inform a pilot to taxi onto the departure runway in takeoff position and hold. It is not authorization for takeoff. It is used when takeoff clearance cannot immediately be issued because of traffic or other reasons. (See Hold, Cleared for Takeoff)

TAXI PATTERNS— Patterns established to illustrate the desired flow of ground traffic for the different runways or airport areas available for use.

TERMINAL AREA— A general term used to describe airspace in which approach control service or airport traffic control service is provided.

TERMINAL AREA FACILITY— A facility providing air traffic control service for arriving and departing IFR, VFR, Special VFR, and on occasion en route aircraft. (See Approach Control, Tower)

TERMINAL CONTROL AREA— (See Controlled Airspace)

TERMINAL RADAR PROGRAM— A national program instituted to extend the terminal radar services provided IFR aircraft to VFR aircraft. Pilot participation in the program is urged but is not mandatory. The program is divided into two parts and referred to as Stage II and Stage III. The Stage service provided at a particular location is contained in the Airport/Facility Directory.

1. Stage I originally comprised two basic radar services (traffic advisories and limited vectoring to VFR aircraft). These services are provided by all commissioned terminal radar facilities, but the term "Stage I" has been deleted from use.
2. Stage II/Radar Advisory and Sequencing for VFR Aircraft—Provides, in addition to the basic radar services, vectoring and sequencing on a full-time basis to arriving VFR aircraft. The purpose is to adjust the flow of arriving IFR and VFR aircraft into the traffic pattern in a safe and orderly manner and to provide traffic advisories to departing VFR aircraft.
3. Stage III/Radar Sequencing and Separation Service for VFR Aircraft—Provides, in addition to the basic radar services and Stage II, separation be-

tween all participating VFR aircraft. The purpose is to provide separation between all participating VFR aircraft and all IFR aircraft operating within the airspace defined as a Terminal Radar Service Area (TRSA) or Terminal Control Area (TCA). (See Controlled Airspace, Terminal Radar Service Area) (Refer to AIM, Airport/Facility Directory)

TERMINAL RADAR SERVICE AREA/TRSA— Airspace surrounding designated airports wherein ATC provides radar vectoring, sequencing, and separation on a full-time basis for all IFR and participating VFR aircraft. Service provided in a TRSA is called Stage III Service. The AIM contains an explanation of TRSA. TRSA's are depicted on VFR aeronautical charts. Pilot participation is urged but is not mandatory. (See Terminal Radar Program) (Refer to AIM, Airport/Facility Directory)

TERRAIN FOLLOWING/TF— The flight of a military aircraft maintaining a constant AGL altitude above the terrain or the highest obstruction. The altitude of the aircraft will constantly change with the varying terrain and/or obstruction.

TETRAHEDRON— A device normally located on uncontrolled airports and used as a landing direction indicator. The small end of a tetrahedron points in the direction of landing. At controlled airports, the tetrahedron, if installed, should be disregarded because tower instructions supersede the indicator. (See Segmented Circle) (Refer to AIM)

THAT IS CORRECT— The understanding you have is right.

THRESHOLD— The beginning of that portion of the runway usable for landing. (See Airport Lighting, Displaced Threshold)

THRESHOLD CROSSING HEIGHT/TCH— The theoretical height above the runway threshold at which the aircraft's glideslope antenna would be if the aircraft maintains the trajectory established by the mean ILS glideslope or MLS glidepath. (See Glide Slope, Threshold)

THRESHOLD LIGHTS— (See Airport Lighting)

TIME GROUP— Four digits representing the hour and minutes from the 24-hour clock. Time groups without time zone indicators are understood to be UTC (Coordinated Universal Time); e.g., "0205." The term "Zulu" is used when ATC procedures require a reference to UTC. A time zone designator is used to indicate local time; e.g., "0205M." The end and the beginning of the day are shown by "2400" and "0000," respectively.

TORCHING— The burning of fuel at the end of an exhaust pipe or stack of a reciprocating aircraft engine, the result of an excessive richness in the fuel air mixture.

*ICAO—TOTAL ESTIMATED ELAPSED TIME/TOTAL EET—*For IFR flights, the estimated time required from takeoff to arrive over that designated point, defined by reference to navigation aids, from which it is intended that an instrument approach procedure will be commenced, or if no navigation aid is associated with the destination aerodrome, to arrive over the destination aerodrome. For VFR flights, the estimated time required from takeoff to arrive over the destination aerodrome (for use in international flight planning). (See Estimated Elapsed Time)

TOUCH-AND-GO/TOUCH-AND-GO LANDING— An operation by an aircraft that lands and departs on a runway without stopping or exiting the runway.

TOUCHDOWN—

1. The point at which an aircraft first makes contact with the landing surface.
2. Concerning a precision radar approach (PAR), it is the point where the glide path intercepts the landing surface.

ICAO—TOUCHDOWN— The point where the nominal glide path intercepts the runway.

TOUCHDOWN RVR— (See Visibility)

TOUCHDOWN ZONE— The first 3,000 feet of the runway beginning at the threshold. The area is used for determination of Touchdown Zone Elevation in the development of straight-in landing minimums for instrument approaches.

TOUCHDOWN ZONE ELEVATION/TDZE— The highest elevation in the first 3,000 feet of the landing surface. TDZE is indicated on the instrument approach procedure chart when straight-in landing minimums are authorized. (See Touchdown Zone)

TOUCHDOWN ZONE LIGHTING— (See Airport Lighting)

TOWER/AIRPORT TRAFFIC CONTROL TOWER— A terminal facility that uses air/ground communications, visual signaling, and other devices to provide ATC services to aircraft operating in the vicinity of an airport or on the movement area. Authorizes aircraft to land or takeoff at the airport controlled by the tower or to transit the airport traffic area regardless of flight plan or weather conditions (IFR or VFR). A tower may also provide approach control services (radar or nonradar). (See Airport Traffic Area, Airport Traffic Control Service, Approach Control/Approach Control Facility, Approach Control Service, Movement Area, Tower En Route Control Service/Tower to Tower) (Refer to AIM)

ICAO—AERODROME CONTROL TOWER— A unit established to provide air traffc control service to aerodrome traffic.

TOWER EN ROUTE CONTROL SERVICE/TOWER TO TOWER— The control of IFR en route traffic within delegated airspace between two or more adjacent approach control facilities. This service is designed to expedite traffic and reduce control and pilot communication requirements.

TPX-42— A numeric beacon decoder equipment/system. It is designed to be added to terminal radar systems for beacon decoding. It provides rapid target identification, reinforcement of the primary radar target, and altitude information from Mode C. (See Automated Radar Terminal Systems, Transponder)

TRACK— The actual flight path of an aircraft over the surface of the earth. (See Course, Route, Flight Path)

*ICAO—TRACK—*The projection on the earth's surface of the path of an aircraft, the direction of which path at any point is usually expressed in degrees from north (true, magnetic, or grid).

TRAFFIC—

1. A term used by a controller to transfer radar identification of an aircraft to another controller for the purpose of coordinating separation action. Traffic is normally issued (a) in response to a handoff or point out, (b) in anticipation of a handoff or point out, or (c) in conjunction with a request for control of an aircraft.
2. A term used by ATC to refer to one or more aircraft.

TRAFFIC ADVISORIES— Advisories issued to alert pilots to other known or observed air traffic which may be in such proximity to the position or intended route of flight of their aircraft to warrant their attention. Such advisories may be based on:

1. Visual observation.
2. Observation of radar identified and nonidentified aircraft targets on an ATC radar display, or
3. Verbal reports from pilots or other facilities.

The word "traffic" followed by additional information, if known, is used to provide such advisories; e.g., "Traffic, 2 o'clock, one zero miles, southbound, eight thousand."

Traffic advisory service will be provided to the extent possible depending on higher priority duties of the controller or other limitations; e.g., radar limitations, volume of traffic, frequency congestion, or controller workload. Radar/nonradar traffic advisories do not relieve the pilot of his responsibility to see and avoid other aircraft. Pilots are cautioned that there are many times when the controller is not able to give traffic advisories concerning all traffic in the aircraft's proximity; in other words, when a pilot requests or is receiving traffic advisories, he should not assume that all traffic will be issued. (Refer to AIM, Radar Traffic Information Service)

(Identification), TRAFFIC ALERT. ADVISE YOU TURN LEFT/RIGHT (specific heading if appropriate), AND/OR CLIMB/DESCEND (specific altitude if appropriate) IMMEDIATELY. (See Safety Alert)

TRAFFIC INFORMATION— (See Traffic Advisories)

TRAFFIC IN SIGHT— Used by pilots to inform a controller that previously issued traffic is in sight. (See Negative Contact, Traffic Advisories)

TRAFFIC NO LONGER A FACTOR— Indicates that the traffic described in a previously issued traffic advisory is no longer a factor.

TRAFFIC PATTERN— The traffic flow that is prescribed for aircraft landing at, taxiing on, or taking off from an airport. The components of a typical traffic pattern are upwind leg, crosswind leg, downwind leg, base leg, and final approach.

1. Upwind Leg—A flight path parallel to the landing runway in the direction of landing.
2. Crosswind Leg—A flight path at right angles to the landing runway off its upwind end.
3. Downwind Leg—A flight path parallel to the landing runway in the direction opposite to landing. The downwind leg normally extends between the crosswind leg and the base leg.
4. Base Leg—A flight path at right angles to the landing runway off its approach end. The base leg normally extends from the downwind leg to the intersection of the extended runway centerline.
5. Final Approach—A flight path in the direction of landing along the extended runway centerline. The final approach normally extends from the base leg to the runway. An aircraft making a straight-in approach VFR is also considered to be on final approach.

(See Straight-In Approach-VFR, Taxi Patterns) (Refer to AIM, FAR Part 91)

ICAO—AERODROME TRAFFIC CIRCUIT— The specified path to be flown by aircraft operating in the vicinity of an aerodrome.

TRANSCRIBED WEATHER BROADCAST/TWEB— A continuous recording of meteorological and aeronautical information that is broadcast on L/MF and VOR facilities for pilots. (Refer to AIM)

TRANSFER OF CONTROL— That action whereby the responsibility for the separation of an aircraft is transferred from one controller to another.

ICAO—TRANSFER OF CONTROL— Transfer of responsibility for providing air traffic control service.

TRANSFERRING CONTROLLER/FACILITY— A controller/facility transferring control of an aircraft to another controller/facility.

ICAO—TRANSFERRING UNIT/CONTROLLER— Air Traffic Control Unit/Air Traffic Controller in the process of transferring the responsibility for providing air traffic control service to an aircraft to the next air traffic control unit/air traffic controller along the route of flight.

TRANSITION—

1. The general term that describes the change from one phase of flight or flight condition to another; e.g., transition from en route flight to the approach or transition from instrument flight to visual flight.
2. A published procedure (SID Transition) used to connect the basic SID to one of several en route airways/jet routes, or a published procedure (STAR Transition) used to connect one of several en route airways/jet routes to the basic STAR. (Refer to SID/STAR Charts)

TRANSITION AREA— (See Controlled Airspace)

TRANSMISSOMETER— An apparatus used to determine visibility by measuring the transmission of light through the atmosphere. It is the measurement source for determining runway visual range (RVR) and runway visibility value (RVV). (See Visibility)

TRANSMITTING IN THE BLIND/BLIND TRANSMISSION— A transmission from one station to other stations in circumstances where two-way communication cannot be established, but where it is believed that the called stations may be able to receive the transmission.

TRANSPONDER— The airborne radar beacon receiver/transmitter portion of the Air Traffic Control Radar Beacon System (ATCRBS) which automatically receives radio signals from interrogators on the ground, and selectively replies with a specific reply pulse or pulse group only to those interrogations being received on the mode to which it is set to respond. (See Interrogator) (Refer to AIM)

*ICAO—TRANSPONDER—*A receiver/transmitter which will generate a reply signal upon proper interrogation; the interrogation and reply being on different frequencies.

TURBOJET AIRCRAFT— An aircraft having a jet engine in which the energy of the jet operates a turbine which in turn operates the air compressor.

TURBOPROP AIRCRAFT— An aircraft having a jet engine in which the energy of the jet operates a turbine which drives the propeller.

T-VOR/TERMINAL-VERY HIGH FREQUENCY OMNIDIRECTIONAL RANGE STATION— A very high frequency terminal omnirange station located on or near an airport and used as an approach aid. (See Navigational Aid, VOR)

TWO WAY RADIO COMMUNICATIONS FAILURE— (See Lost Communications)

ULTRAHIGH FREQUENCY/UHF— The frequency band between 300 and 3,000 MHz. The bank of radio frequencies used for military air/ground voice communications. In some instances this may go as low as 225 MHz and still be referred to as UHF.

ULTRALIGHT VEHICLE— An aeronautical vehicle operated for sport or recreational purposes which does not require FAA registration, an airworthiness certificate, nor pilot certification. They are primarily single occupant vehicles, although some two-place vehicles are authorized for training purposes. Operation of an ultralight vehicle in certain airspace requires authorization from ATC. (See FAR 103)

UNABLE— Indicates inability to comply with a specific instruction, request, or clearance.

UNCONTROLLED AIRSPACE— Uncontrolled airspace is that portion of the airspace that has not been designated as continental control area, control area, control zone, terminal control area, or transition area and within which ATC has neither the authority nor the responsibility for exercising control over air traffic. (See Controlled Airspace)

UNDER THE HOOD— Indicates that the pilot is using a hood to restrict visibility outside the cockpit while simulating instrument flight. An appropriately rated pilot is required in the other control seat while this operation is being conducted. (Refer to FAR, Part 91)

UNICOM— A nongovernment communication facility which may provide airport information at certain airports. Locations and frequencies of UNICOMs are shown on aeronautical charts and publications. (Refer to AIM, Airport/Facility Directory)

UNPUBLISHED ROUTE— A route for which no minimum altitude is published or charted for pilot use. It may include a direct route between NAVAIDS, a radial, a radar vector, or a final approach course beyond the segments of an instrument approach procedure. (See Published Route, Route)

UPWIND LEG— (See Traffic Pattern)

URGENCY— A condition of being concerned about safety, and of requiring timely but not immediate assistance; a potential Distress condition.

ICAO—URGENCY— A condition concerning the safety of an aircraft or other vehicle, or of person on board or in sight, but which does not require immediate assistance.

VECTOR— A heading issued to an aircraft to provide navigational guidance by radar.

ICAO—RADAR VECTORING— Provision of navigational guidance to aircraft in the form of specific headings, based on the use of radar.

VERIFY— Request confirmation of information; e.g., "verify assigned altitude."

VERIFY SPECIFIC DIRECTION OF TAKEOFF (OR TURNS AFTER TAKEOFF)— Used by ATC to ascertain an aircraft's direction of takeoff and/or direction of turn after takeoff. It is normally used for IFR departures from an airport not having a control tower. When direct communication with the pilot is not possible, the request and information may be relayed through an FSS, dispatcher, or by other means. (See IFR Takeoff Minimums and Departure Procedures)

VERTICAL SEPARATION— Separation established by assignment of different altitudes or flight levels. (See Separation)

*ICAO—VERTICAL SEPARATION—*Separation between aircraft expressed in units of vertical distance.

VERTICAL TAKEOFF AND LANDING AIRCRAFT/VTOL AIRCRAFT— Aircraft capable of vertical climbs and/or descents and of using very short runways or small areas for takeoff and landings. These aircraft include, but are not limited to, helicopters. (See Short Takeoff and Landing Aircraft)

VERY HIGH FREQUENCY/VHF— The frequency band between 30 and 300 MHz. Portions of this band, 108 to 118 MHz, are used for certain NAVAIDS; 118 to 136 MHz are used for civil air/ground voice communications. Other frequencies in this band are used for purposes not related to air traffic control.

VERY LOW FREQUENCY/VLF— The frequency band between 3 and 30 kHz.

VFR AIRCRAFT/VFR FLIGHT— An aircraft conducting flight in accordance with visual flight rules. (See Visual Flight Rules)

***VFR CONDITIONS*—** Weather conditions equal to or better than the minimum for flight under visual flight rules. The term may be used as an ATC clearance/instruction only when:

1. An IFR aircraft requests a climb/descent in VFR conditions.
2. The clearance will result in noise abatement benefits where part of the IFR departure route does not conform to an FAA approved noise abatement route or altitude.
3. A pilot has requested a practice instrument approach and is not on an IFR flight plan.

All pilots receiving this authorization must comply with the VFR visibility and distance from cloud criteria in FAR Part 91. Use of the term does not relieve controllers of their responsibility to separate aircraft in TCAs/TRSAs as required by FAA Handbook 7110.65. When used as an ATC clearance/instruction, the term may be abbreviated "VFR;" e.g., "MAINTAIN VFR," "CLIMB/DESCEND VFR," etc.

***VFR-ON-TOP*—** ATC authorization for an IFR aircraft to operate in VFR conditions at any appropriate VFR altitude (as specified in FAR and as restricted by ATC). A pilot receiving this authorization must comply with the VFR visibility, distance from cloud criteria, and the minimum IFR altitudes specified in FAR Part 91. The use of this term does not relieve controllers of their responsibility to separate aircraft in TCAs/TRSAs as required by FAA Handbook 7110.65.

VFR MILITARY TRAINING ROUTES (VR)— Routes used by the Department of Defense and associated Reserve and Air Guard units for the purpose of conducting low-altitude navigation and tactical training under VFR below 10,000 feet MSL at airspeeds in excess of 250 knots IAS.

***VFR NOT RECOMMENDED*—** An advisory provided by a flight service station to a pilot during a preflight or inflight weather briefing that flight under visual flight rules is not recommended. To be given when the current and/or forecasted weather conditions are at or below VFR minimums. It does not abrogate the pilot's authority to make his own decision.

VIDEO MAP— An electronically displayed map on the radar display that may depict data such as airports, heliports, runway centerline extensions, hospital emergency landing areas, NAVAIDS and fixes, reporting points, airway/route centerlines, boundaries, handoff points, special use tracks, obstructions, prominent geographic features, map alignment indicators, range accuracy marks, minimum vectoring altitudes.

VISIBILITY— The ability, as determined by atmospheric conditions and expressed in units of distance, to see and identify prominent unlighted objects by day and prominent lighted objects by night. Visbility is reported as statute miles, hundreds of feet or meters. (Refer to FAR Part 91, AIM)

1. Flight Visibility—The average forward horizontal distance, from the cockpit of an aircraft in flight, at which prominent unlighted objects may be seen and identified by day and prominent lighted objects may be seen and identified by night.

ICAO—Flight Visibility—The visibility forward from the cockpit of an aircraft in flight.

2. Ground Visibility—Prevailing horizontal visibility near the earth's surface as reported by the United States National Weather Service or an accredited observer.

ICAO—Ground Visibility—The visibility at an aerodrome as reported by an accredited observer.

3. Prevailing Visibility—The greatest horizontal visibility equaled or exceeded throughout at least half the horizon circle which need not necessarily be continuous.
4. Runway Visibility Value/RVV—The visibility determined for a particular runway by a transmissometer. A meter provides a continuous indication of the visibility (reported in miles or fractions of miles) for the runway. RVV is used in lieu of prevailing visibility in determining minimums for a particular runway.
5. Runway Visual Range/RVR—An instrumentally derived value, based on standard calibrations, that represents the horizontal distance a pilot will see down the runway from the approach end. It is based on the sighting of either high intensity runway lights or on the visual contrast of other targets whichever yields the greater visual range. RVR, in contrast to prevailing or runway visibility, is based on what a pilot in a moving aircraft should see looking down the runway. RVR is horizontal visual range, not slant visual range. It is based on the measurement of a transmissometer made near the touchdown point of the instrument runway and is reported in hundreds of feet. RVR is used in lieu of RVV and/or prevailing visibility in determining minimums for a particular runway.
    - a. Touchdown RVR—The RVR visibility readout values obtained from RVR equipment serving the runway touchdown zone.
    - b. MID RVR—The RVR readout values obtained from RVR equipment located midfield of the runway.
    - c. Rollout RVR—The RVR readout values obtained from RVR equipment located nearest the rollout end of the runway.

ICAO—Runway Visual Range—The maximum distance in the direction of takeoff or landing at which the runway or the specified lights or markers delineating it can be seen from a position above a specified point on its centerline at a height corresponding to the average eye-level of pilots at touchdown.

VISUAL APPROACH— An approach wherein an aircraft on an IFR flight plan, operating in VFR conditions under the control of an air traffic control facility and having an air traffic control authorization, may proceed to the airport of destination in VFR conditions.

ICAO—VISUAL APPROACH—An approach by an IFR flight when either part or all of an instrument approach procedure is not completed and the approach is executed in visual reference to terrain.

VISUAL APPROACH SLOPE INDICATOR— (See Airport Lighting)

VISUAL DESCENT POINT/VDP— A defined point on the final approach course of a nonprecision straight-in approach procedure from which normal descent from the MDA to the runway touchdown point may be commenced, provided the approach threshold of that runway, or approach lights, or other markings identifiable with the approach end of that runway are clearly visible to the pilot.

VISUAL FLIGHT RULES/VFR— Rules that govern the procedures for conducting flight under visual conditions. The term "VFR" is also used in the United States to indicate weather conditions that are equal to or greater than minimum VFR requirements. In addition, it is used by pilots and controllers to indicate type of flight plan. (See Instrument Flight Rules, Instrument Meteorological Conditions, Visual Meteorological Conditions) (Refer to FAR, Part 91 and AIM)

VISUAL HOLDING— The holding of aircraft at selected, prominent geographical fixes which can be easily recognized from the air. (See Hold, Holding Fixes)

VISUAL METEOROLOGICAL CONDITIONS/VMC— Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling equal to or better than specified minima. (See Instrument Flight Rules, Instrument Meteorological Conditions, Visual Flight Rules)

VISUAL SEPARATION— A means employed by ATC to separate aircraft in terminal areas. There are two ways to effect this separation:

1. The tower controller sees the aircraft involved and issues instructions, as necessary, to ensure that the aircraft avoid each other.
2. A pilot sees the other aircraft involved and upon instructions from the controller provides his own separation by maneuvering his aircraft as necessary to avoid it. This may involve following another aircraft or keeping it in sight until it is no longer a factor. (See See and Avoid) (Refer to FAR, Part 91)

VORTAC/VHF OMNIDIRECTIONAL RANGE/TACTICAL AIR NAVIGATION— A navigation aid providing VOR azimuth, TACAN azimuth, and TACAN distance measuring equipment (DME) at one site. (See Distance Measuring Equipment, Navigational Aid TACAN, VOR) (Refer to AIM)

VORTICES/WING TIP VORTICES— Circular patterns of air created by the movement of an airfoil through the air when generating lift. As an airfoil moves through the atmosphere in sustained flight, an area of area of low pressure is created above it. The air flowing from the high pressure area to the low pressure area around and about the tips of the airfoil tends to roll up into two rapidly rotating vortices, cylindrical in shape. These vortices are the most predominant parts of aircraft wake turbulence and their rotational force is dependent upon the wing loading, gross weight, and speed of the generating aircraft. The vortices from medium to heavy aircraft can be of extremely high velocity and hazardous to smaller aircraft. (See Aircraft Classes Wake Turbulence) (Refer to AIM)

VOR/VERY HIGH FREQUENCY OMNIDIRECTIONAL RANGE STATION— A ground-based electronic navigation aid transmitting very high frequency navigation signals, 360 degrees in azimuth, oriented from magnetic north. Used as the basis for navigation in the National Airspace System. The VOR periodically identifies itself by Morse Code and may have an additional voice identification feature. Voice features may be used by ATC or FSS for transmitting instructions/information to pilots. (See Navigational Aid) (Refer to AIM)

VOT/VOR TEST SIGNAL— A ground facility which emits a test signal to check VOR receiver accuracy. Some VOT's are available to the user while airborne, and others are limited to ground use only. (Refer to FAR, Part 91, AIM, Airport/Facility Directory)

WAKE TURBULENCE— Phenomena resulting from the passage of an aircraft through the atmosphere. The term includes vortices, thrust stream turbulence, jet blast, jet wash, propeller wash, and rotor wash both on the ground and in the air. (See Aircraft Classes, Jet Blast, Vortices) (Refer to AIM)

WARNING AREA— (See Special Use Airspace)

WAYPOINT— A predetermined geographical position used for route/instrument approach definition, or progress reporting purposes, that is defined relative to a VORTAC station or in terms of latitude/longitude coordinates.

WEATHER ADVISORY/INFLIGHT WEATHER ADVISORY— (See SIGMET, AIRMET)

WEATHER ADVISORY/WS/WST/WA/CWA— In aviation weather forecast practice, an expression of hazardous weather conditions not predicted in the area forecast, as they affect the operation of air traffic and as prepared by the NWS.

***WHEN ABLE*—** When used in conjunction with ATC instructions, gives the pilot the latitude to delay compliance until a condition or event has been reconciled. Unlike "pilot discretion," when instructions are prefaced "when able," the pilot is expected to seek the first opportunity to comply. Once a maneuver has been initiated, the pilot is expected to continue until the specifications of the instructions have been met. "When able," should not be used when expeditious compliance is required.

***WILCO*—** I have received your message, understand it, and will comply with it.

WIND SHEAR— A change in wind speed and/or wind direction in a short distance resulting in a tearing or shearing effect. It can exist in a horizontal or vertical direction and occasionally in both.

WORDS TWICE—

1. As a request: "Communication is difficult. Please say every phrase twice."
2. As information: "Since communications are difficult, every phrase in this message will be spoken twice."

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